

# BAYOU TREPAGNIER OPERABLE UNIT 1 REMEDIAL DESIGN

AGENCY INTEREST NO. 44765

Remediation Services Division	
Manager:	<u>Hulk</u>
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AI #:	<u>44765</u>
TEMPO Task #:	
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Prepared for

**MOTIVA**  
ENTERPRISES LLC  
Norco, Louisiana

June 12, 2008

File No. 25009269

**URS**

URS Corporation  
7389 Florida Blvd., Suite 300  
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LDEQ RECEIPT

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**MOTIVA**  
ENTERPRISES LLC

June 12, 2008

HAND DELIVERY

Mr. Keith L. Casanova, Administrator  
Louisiana Department of Environmental Quality  
Office of Environmental Assessment  
Remediation Services Division  
P.O. Box 4314  
Baton Rouge, LA 70821-4314

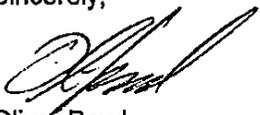
**SUBJECT: Transmittal of Remedial Design  
Bayou Trepagnier Operable Unit 1  
Bayou Trepagnier, Norco, St. Charles Parish, Louisiana  
Agency Interest Number: 44765**

Dear Mr. Casanova:

Motiva Enterprises, LLC is pleased to submit the enclosed three (3) hard copies of the Remedial Design for Bayou Trepagnier Operable Unit 1 (OU1).

Motiva very much appreciates the opportunity to move forward with the Department on this important project. If you have any questions or comments regarding this matter, please do not hesitate to contact me at (504) 465-6315.

Sincerely,

  
Oliver Boyd  
Manager – Environmental  
Motiva Norco Refinery

Attachment

**BAYOU TREPAGNIER  
OPERABLE UNIT 1  
REMEDIAL DESIGN**

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This Remedial Design document provides the overall project design concept for the Final Remedy for Operable Unit 1 (OU1) of Bayou Trepagnier, in accordance with Section IX.B.1 of the February 14, 2008 Cooperative Agreement between the Louisiana Department of Environmental Quality (LDEQ) and Motiva Enterprises, LLC (Motiva) (LDEQ 2008). The LDEQ Decision Document for OU1 (LDEQ 2007) identified a Restoration Compatible Sediment Cap as the Final Remedy to provide long-term reduction of current and future risks to biota, and to create a base for establishment of additional floral and faunal habitat. The OU1 Final Remedy comprises the following components:

- Construction of an 800-foot long Clean Zone (Stations 5+00 to 13+00) for potential future conveyance of Mississippi River water into the LaBranche wetlands for coastal restoration;
- Sediment solidification and capping for the remaining 4,750 feet of OU1 (Stations 13+00 to 60+50); and
- Closure of the Cut connecting Bayou Trepagnier and Engineer's Canal.

The Cooperative Agreement specifies two work plans for the OU1 Final Remedy: (1) OU1 Remedial Design; and (2) OU1 Remedial Project Plan. This document, the OU1 Remedial Design, provides the following:

- Conceptual design for closure of the Upper Reach and the Cut based on current information;
- Identification of data gaps for development of the OU1 Remedial Project Plan;
- Schedule that includes collection of data specific to the remedial design; and
- Discussion of permitting requirements and access agreements for implementation of the Final Remedy.

Upon the LDEQ's approval of this OU1 Remedial Design document, Motiva will proceed with gathering the information identified as data gaps. Within 60 calendar days of collection and evaluation of all of these data, Motiva will submit the OU1 Remedial Project Plan to the LDEQ as specified in Section IX.B.2 of the Cooperative Agreement.

This section summarizes the site history and existing conditions at Bayou Trepagnier.

## 1.1 SITE HISTORY

Bayou Trepagnier is located within the LaBranche Wetlands in southeastern Louisiana (St. Charles Parish) near the City of Norco (Figure 1), approximately 10 miles west of New Orleans. The Bayou, a remnant of a former Mississippi River crevasse distributary channel, was historically used by Native Americans as a link from the Mississippi River to Lake Pontchartrain and the Gulf of Mexico. Construction of the New Orleans Refining Company (NORCO) facility along the Mississippi River near Bayou Trepagnier began in 1916. The facility initiated refining operations in 1920, and the town that surrounded the facility adopted the facility acronym as its name. From 1920 to 1929, wastewater and stormwater from NORCO and other industries around the facility, as well as from the town, were discharged to Bayou Trepagnier.

Shell Petroleum Corporation (Shell) purchased and began operating the refinery in 1929. In 1930, the United States Army Corps of Engineers (USACE) constructed a spillway at Bonnet Carré, just upstream of Norco. The spillway's lower guide levee extends from the Mississippi River to Lake Pontchartrain, eliminating the upper portion of Bayou Trepagnier. Beginning in the mid-1930s, the NORCO facility discharged to the man-made canal leading to Bayou Trepagnier. The Louisiana Department of Public Works dredged the canal and Bayou Trepagnier in 1951 and placed the dredged sediments in spoil banks, primarily along the western shoreline. Both the man-made canal (Station 0+00 to approximately Station 97+00 [Evans 2002]) and the downstream Bayou channel (Station 97+00 to Station 160+00) are collectively referred to as Bayou Trepagnier for the purposes of this work plan. In 1995 the refinery ceased permitted discharges into Bayou Trepagnier. The refinery has been owned and operated by Motiva since 1998. Constituents of concern (COCs) identified for Bayou Trepagnier include lead, chromium, copper, zinc, and individual polycyclic aromatic hydrocarbons (PAHs).

## 1.2 EXISTING CONDITIONS

Bayou Trepagnier extends approximately 15,500 feet northward from the Hurricane Protection Levee (HPL) to its confluence with Bayou LaBranche. The Bayou is divided into three reaches: Upper, Middle, and Lower. For ease of reference, station numbers are assigned

referring to the distance (in hundreds of feet), along the centerline of the channel downstream from the Norco Refinery (Figure 2):

- The Upper Reach (Stations 5+00 to 60+50) extends approximately 5,550 feet from the HPL to the narrow “Cut” which connects Bayou Trepagnier to Engineer’s Canal;
- The Middle Reach (Stations 60+50 to 115+00) extends approximately 5,550 feet from the Cut northward; and
- The Lower Reach (Stations 115+00 to 160+00) extends approximately 4,500 feet from the north end of the Middle Reach to Bayou LaBranche.

OU1 is comprised of the Upper Reach; Operable Unit 2 (OU2) is comprised of the Middle and Lower Reaches. The width of Bayou Trepagnier varies from approximately 25 to 60 feet, being generally narrower in its upper reach and wider in portions of the lower reach. Bayou LaBranche flows northwesterly for about one mile from its junction with Bayou Trepagnier before emptying into Lake Pontchartrain. Bayou Trepagnier is a designated, protected Louisiana Natural and Scenic Stream. The banks of the Bayou are covered with typical second-growth wetland forest. Cypress-Tupelo swamp, marsh, and open water areas exist between Bayou Trepagnier and Bayou LaBranche.

Bayou Trepagnier is hydrologically connected to the LaBranche Wetlands via sloughs which enter on both banks. Flow in Bayou Trepagnier is dominated by tidal and wind-driven water level fluctuations in Lake Pontchartrain, and water in the Bayou is fresh to mildly brackish. Extreme weather events, such as heavy short-term rainfalls and stormwater surges from Engineer’s Canal, tropical storm surges from Lake Pontchartrain, and extended droughts, have had significant impacts on salinity regimes in Bayou Trepagnier.

As previously discussed, two banks of spoil material dredged from Bayou Trepagnier in 1951 lie parallel to the channel, one along approximately two-thirds of its western shoreline and one along a small portion of the eastern shoreline (Figure 2). The majority of spoil bank material is located along the Upper Reach (OU1). The OU1 portion of the Bayou is generally about 30 feet wide, with typical water depths of two to three feet overlying six to eight feet of soft sediment. OU1 cross sections, which were originally presented in the Bayou Trepagnier Feasibility Study Supplement II (Motiva 2006), are provided in Appendix A.

This section summarizes the project objectives for the OU1 Final Remedy. The LDEQ's OU1 Decision Document (LDEQ 2007) identified a Restoration Compatible Sediment Cap as the Final Remedy to provide long-term reduction of risks to biota as well as create a base for establishment of additional floral and faunal habitat.

Phase I consists of construction of a Clean Zone from Stations 5+00 to 13+00 (800 feet) for potential conveyance of Mississippi River water into the LaBranche wetlands for coastal restoration. Sediments and spoil banks in this area having COC concentrations above: (1) both LDEQ Risk Evaluation/Corrective Action Program (RECAP) non-industrial soil screening levels and soil background levels for organics; or (2) soil background levels for metals (inorganics); will be removed, solidified, and placed into the Bayou channel between Stations 13+00 and 60+50 prior to capping.

Phase II consists of sediment solidification and capping from Station 13+00 to 60+50, with a no minimum draft condition. Sediment and spoil bank soils will be solidified with one or more reagents. The cap, which will likely consist of either: (1) Bonnet Carré spillway earthen material, or (2) Mississippi River sand and an overlying layer of Bonnet Carré spillway earthen material, will mitigate contact with the underlying materials and support vegetation. There are no hydraulic conductivity, settlement, strength or compaction criteria proposed for the cap. Closure of the Cut connecting Bayou Trepagnier and Engineer's Canal is included in the OU1 remedial action to reduce cross flow of brackish water between the two channels.

A separate RECAP Management Option 3 (MO-3) investigation of OU2 will evaluate sediments, dredge spoils, and adjacent soils in the Middle and Lower Reach (OU2) as well as dredge spoils and adjacent soils not included in the current remedial action for the Upper Reach (OU1). Any such soils and/or sediments requiring remediation will be solidified and placed into the Bayou channel between Stations 13+00 and 60+50.

This section summarizes the proposed project execution for the OU1 Final Remedy. Upon receipt of the LDEQ's concurrence with this approach, Motiva will conduct the additional studies described in Section 4 to address existing data gaps. Those study results will then be used to develop a Remedial Project Plan in accordance with Section IX.B.2 of the Cooperative Agreement.

### **3.1 PERMITS AND OTHER APPROVALS**

The OU1 remedy will require several permits and other approvals. Authorization for the proposed project will be obtained from the Louisiana Department of Natural Resources (LDNR) and the USACE prior to any construction. Motiva will submit a joint permit application and associated drawings to the LDNR for a coastal use permit (CUP). The LDNR will serve as a clearinghouse and forward copies of the application package to the commenting agencies, including the USACE. The joint permit application will serve as the application to the USACE and will contain, at a minimum, the necessary information for a pre-construction notification (PCN) for a nationwide permit No 38. The USACE will process the application as a nationwide permit, a programmatic general permit (PGP), or an individual permit. A similar process will be required to obtain LDNR and USACE permits to conduct the data gap investigations as the proposed work involves land clearing activities and sampling within the coastal zone and wetlands (see Section 4).

Pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(e)(1), 42 U.S.C. § 9621(e)(1), and Louisiana Environmental Quality Act (LEQA) Louisiana Revised Statutes Title 30, Section 2275.E (La. R.S. 30:2275.E),<sup>1</sup> the remedial action will be conducted pursuant to the OU1 Remedial Project Plan in lieu of being subject to the Louisiana Pollution Discharge Elimination System (LPDES) General Permit No. LAR100000 – Stormwater General Permit for Construction Activities Five (5) Acres or More (effective 10/1/04). Details regarding discharge monitoring requirements will be included in the OU1 Remedial Project Plan, and that plan will constitute the Notice of Intent (NOI).

In accordance with La. R.S. 56:1855.L, a scenic river permit from the Louisiana Department of Wildlife & Fisheries is not required for Bayou Trepagnier activities performed under a state or federal remediation and restoration plan, when work is needed to remove, treat, or

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<sup>1</sup> Citations herein are to the West Publishing Company 2008 annotated Louisiana Revised Statutes.

isolate contaminated sediments within or adjacent to the Bayou. Construction approvals and letters of no objection are required for activities associated with the HPL and Bonnet Carré Spillway levee (e.g., investigation borings and remediation). The construction approvals and letters of no objection will be obtained from the USACE, St. Charles Parish Department of Public Works, Louisiana Department of Transportation and Development, and Lake Pontchartrain Levee Board prior to start of construction work.

### **3.2 SITE SUPPORT AREAS AND CONTROLS**

A site support area inside the HPL (Figure 3) will be included in the design. The associated administrative facilities will include office trailers and parking to accommodate full-time and part-time personnel; a break room for construction personnel; and tool storage. The design will include provision of utilities, potable water, and sanitation services at the trailers. Access to this area is through the Bayou Trepagnier pump station and is restricted by an existing security fence and gate. An additional site support area may also be needed along the Bonnet Carré Lower Guide Levee opposite the Cut (Figure 3), and a construction material stockpile area is required for storing of reagent(s), etc. The locations and dimensions of these support areas will be further defined in the OU1 Remedial Project Plan, based in part on the data gap analyses (e.g., contractor constructability reviews) described in Section 4.

Site controls (e.g., work zones, security, safe work practices, decontamination stations) will be established to protect remediation workers and site visitors, and to prevent the spread of potentially contaminated soil to unaffected portions of the site or off site areas. Temporary fencing and signage will be placed near Station 60.5 to restrict the public from entering the work area. Trees and other vegetation cleared during site preparation will be chipped and spread within the LaBranche Wetlands in the vicinity of the work area.

In the event of an approaching hurricane, remediation work in Bayou Trepagnier will be secured to the extent practicable in the time available. Materials and equipment outside the HPL will be demobilized, and remobilized after the storm has passed and flood waters have receded. A hurricane preparedness plan will be a required contractor submittal.

### **3.3 CONSTRUCTION ROADS**

The design will include an approximately 30-foot wide construction road along the length of OU1 to efficiently access the Bayou channel for sediment solidification. Limiting sediment

solidification activities to the Bayou channel itself (i.e., no bank clearing outside of the Clean Zone and Support Areas) is not feasible given the: (1) limited reach of applicable construction equipment; and (2) time required for sediments to achieve sufficient strength to support the same heavy equipment so that downstream sediments can be accessed and solidified.

It is currently anticipated that this construction road will be built along the eastern shoreline of OU1 to minimize disturbance of the spoil banks (Figure 3). Since spoil banks exist along the eastern shoreline of OU1 from approximately Station 49+00 to Station 60+50, the OU2 MO-3 evaluation will help determine whether those areas can be disturbed. If not, the construction road will likely transition from the eastern shoreline to the western shoreline (across the solidified channel) at approximately Station 49+00. Construction of similar temporary roads will also be required along the western edge of the Clean Zone and the southern edge of the Cut to access those areas.

Thirty-foot wide construction roads will allow for two-way truck traffic. The construction roads will require clearing approximately 50-foot wide corridors. Turnarounds (to allow vehicles to reverse direction) will also be constructed approximately every 1,000 feet. A design for the construction roads will be provided in the OU1 Remedial Project Plan after the data gap analyses (e.g., geotechnical investigation and contractor constructability reviews) and a cost/benefit evaluation (that considers impacts to the environment, strength, longevity, and safety) are completed.

Potential alternatives for the construction road surface include hardwood mats (a "board road") and high density polyethylene (HDPE) DURA-BASE<sup>®</sup> mats. Even though the construction roads will be temporary, substantial subgrade preparation is anticipated given the marshy soils, uneven ground, and volume of heavy truck traffic. For example, a geotextile and/or geogrid will likely be needed underneath the road surface to mitigate mud intrusion and distribute equipment loads.

### **3.4 IN-SITU SEDIMENT SOLIDIFICATION**

Motiva currently envisions performing in-situ, in-the-dry solidification of sediments, whereby the overlying surface water is removed to the extent practicable prior to mixing one or more reagents into the soft sediments to a depth sufficient to enable construction of the overlying cap. The amount of admixture will be determined by treatability testing and field

confirmation. The selection of reagent(s) for the OUI Final Remedy will be based on results from the bench scale and pilot testing as well as an evaluation of the relative cost, availability, and prior track record of the reagents (see Section 4).

The existing lateral and vertical extents of soft sediments in OUI are presented in cross sections provided in Appendix A. These cross sections were previously included in the OUI Feasibility Study Supplement II (Motiva 2006). Selected cross sections will be resurveyed as a part of the data gap analysis to confirm current conditions (see Section 4).

It is anticipated that approximately 50-60% of the Bayou channel can be efficiently solidified in-place using long stick excavator(s) positioned on the construction road, given the approximate width of the Bayou (30 feet) and the thickness of soft sediment (6 to 8 feet). The excavators would work downstream along the construction road until the adjacent sediments exhibit sufficient strength to support heavy equipment. The excavators could then be repositioned to work atop the previously solidified sediments in order to access the remaining 40-50% of the channel width. The most efficient approach to staging such activities will be determined by the contractor.

Figure 4 presents a conceptual bayou cross section for current conditions based on the cross sections presented in Appendix A. Figure 5 presents a conceptual bayou cross section for future (post remediation) conditions for Stations 13+00 to 60+50. The cap design grades and elevations to be presented in the OUI Remedial Project Plan will be based on the volume of soil and sediment requiring removal from the Clean Zone.

Sequential segments of OUI will be isolated and dewatered so that the sediments can be solidified in-the-dry. The length of these segments will be determined in part by the slope stability analysis and contractor constructability reviews discussed in Section 4. It is currently envisioned that portable structures such as AquaDams® will be placed perpendicular to the Bayou channel to isolate the working segments. AquaDams®, which are available in multiple sizes, consist of two independent watertight tubes placed inside a larger outer tube constructed of woven geotextile material. The dams are inflated by pumping water into the two inner tubes; the outer tube confines the water-inflated inner tubes and prevents them from moving away from one another. These dams are flexible to allow them to conform to uneven surfaces, thereby providing an effective seal with the ground surface.

Portable pumps will be used to remove the overlying water in the Bayou segments. A description of proposed water management practices is discussed below.

### **3.5 WATER MANAGEMENT**

Water management during remediation operations is a critical activity to prevent frequent inundation of the work area and unauthorized discharge of COCs to surrounding waters. This includes management of the existing surface water in Bayou reaches being dewatered, as well as management of direct rainfall, stormwater runoff, groundwater recharge, and water originating from the LaBranche Wetlands, Engineer's Canal, or Lake Pontchartrain.

Portable pumps will be used to remove the overlying surface water in the Bayou segments. Silt fences, hay logs, and absorbent booms will be used for settling of suspended solids and hydrocarbon sheen control. It may be necessary to use small (e.g., two-foot high) AquaDams® or similar portable structures along both banks of the dewatered reaches to isolate the work area and prevent inundation during periods of elevated water levels in the LaBranche Wetlands. Absorbent booms will be employed downstream of where water is pumped into the open waters of Bayou Trepagnier to capture any hydrocarbon sheens produced from disturbances of unremediated Bayou sediments. Absorbent booms will also be placed in Engineer's Canal during solidification and capping of the Cut. Additional details regarding water management and hydrocarbon sheen control will be presented in the OUI Remedial Project Plan, based on the contractor constructability reviews and pilot test results (see Section 4).

### **3.6 CLEAN ZONE EXCAVATION**

An 800-foot long Clean Zone will be constructed from Stations 5+00 to 13+00 for potential conveyance of Mississippi River water into the LaBranche wetlands for coastal restoration (Figure 3). Within these lateral limits, spoil bank soils and sediments with COC concentrations exceeding RECAP non-industrial soil screening levels and site background levels for organics, or site background levels for metals (inorganics), will be excavated and transported to the remaining portion of the OUI channel (Stations 13+00 to 60+50) for solidification. The excavated Clean Zone area will be backfilled, likely with either Bonnet Carré spillway earthen material or Mississippi River sand.

While construction of an 800-foot long Clean Zone for potential future conveyance of Mississippi River water is included within the OU1 Final Remedy, construction of a freshwater diversion canal is not. Motiva is currently working with natural resource trustee representatives to evaluate a potential freshwater diversion canal for conveyance of City of Norco stormwater into the LaBranche Wetlands. Such a conveyance would also require installation of a permanent barrier (e.g., sheet pile wall) in Engineer's Canal just downstream of the pump station to block surface water discharge in that direction. If the design basis for the freshwater diversion channel is agreed-to by Motiva and the natural resource trustees, the specifics will be incorporated into the OU1 Remedial Project Plan.

### **3.7 RESTORATION COMPATIBLE SEDIMENT CAP**

The Restoration Compatible Sediment Cap will provide long-term reduction of current and future risks to biota, and create a base for establishment of additional floral and faunal habitat. After sediment/soil solidification, the cap will be constructed over the solidified materials to prevent contact with the underlying sediments/soils and to encourage revegetation. The cap will likely consist of either: (1) a 24-inch layer of Bonnet Carré spillway earthen material; or (2) an 18-inch layer of Mississippi River sand and a 6-inch overlying layer of Bonnet Carré spillway earthen material. Final selection of the cap materials, as well as the cap thickness, will be provided in the OU1 Remedial Project Plan. Vegetation of the cap will be encouraged by planting native, salt tolerant trees (e.g., tupelo, gums, water oaks, palmettos) and grasses. There are no permeability, settlement, strength or compaction criteria proposed for the cap. Settlement of the cap during the monitoring period is not proposed as a performance criterion.

The volume of soil and sediment to be removed from the Clean Zone is a data gap. Final design elevations for the restoration compatible sediment cap will therefore be developed for the OU1 Remedial Project Plan based on volume estimates of: (1) soil and sediment to be removed from the Clean Zone; and (2) bulking from addition of reagents versus consolidation from partial dewatering of surficial Bayou sediments.

### **3.8 REVEGETATION OF AREAS IMPACTED BY CONSTRUCTION ACTIVITIES**

After all remediation activities are completed, the construction roads will be removed. Because of the aforementioned subgrade preparation, the remaining road base will remain at an elevation slightly above the surrounding grade level. Revegetation of areas disturbed

during construction activities will be encouraged by planting native, salt tolerant trees and grasses.

### **3.9 OTHER CONSIDERATIONS**

A state designated archaeological site (16SC80) has been identified along the western side of Bayou Trepagnier near Station 28+00. Final delineation of the eastern boundary of the site by Coastal Environments, Inc. (Kelley 2008) shows that intact midden deposits (i.e., material associated with past human occupation, such as *Rangia* shells and artifacts) extend to within 5 meters of the western bank of the Bayou in at least one location. The archaeological site, and a buffer zone around the site, will be designated as a "No Work Zone" and will be fenced-off during remediation activities to prevent inadvertent disturbance.

No threatened or endangered (T&E) species are known to be present in the immediate vicinity of OU1. U.S. Fish and Wildlife Service (USFWS) will be consulted to confirm the distance to any known bald eagle nests or other T&E locations. Any T&E species observed during the upcoming OU2 investigation (which includes sampling in the Upper, Middle, and Lower Reaches) will also be noted in the OU1 Remedial Project Plan.

The USACE has developed plans to raise the height of the HPL from 13 feet to 17 feet, the 100-year flood elevation. Since space constraints prevent simultaneous implementation of both projects, modifications to the HPL will take precedence over the OU1 remediation if the schedules conflict.

This section reviews the data gaps identified to-date.

#### **4.1 SEDIMENT THICKNESS**

Existing cross sections of the top and bottom of soft sediments in OU1 (Appendix A) were developed to support remediation design and detailed quantity take-offs. Several of these cross sections will be resurveyed to confirm current conditions. Depending on the results of this initial effort, resurveying of additional cross sections may be needed.

#### **4.2 SOIL BACKGROUND CONCENTRATIONS**

Proposed soil background sampling locations (see Figure 7) and the associated list of COCs will be included in the revised OU2 MO-3 Work Plan (Revision 1). The soil background levels calculated for the OU2 MO-3 Report will be used in defining the vertical excavation limits for the OU1 Clean Zone.

#### **4.3 VERTICAL DELINEATION OF CLEAN ZONE**

As with the aforementioned Bayou cross sections, vertical delineation of COCs in the Clean Zone is required to support detailed quantity take-offs and remediation design. Several borings will be drilled through the spoil banks to sample and analyze underlying soils for the presence of site COCs. The sampling can be conducted with a small track mounted drilling or Geoprobe® rig to minimize disturbances to the spoil piles. This effort may be conducted in conjunction with the geotechnical borings discussed below. Several borings will also be advanced in the Bayou channel to vertically delineate site COCs in the underlying soils. This sampling can be conducted with a vibrocore unit or a Geoprobe® rig mounted on an airboat. All borings will be backfilled in accordance with Section 5.6 of the Construction of Geotechnical Boreholes and Groundwater Monitoring Systems Handbook (LDEQ/LDOTD 2000).

#### **4.4 GEOTECHNICAL INVESTIGATION**

A geotechnical investigation will be conducted to support the design of the construction roads (Section 3.3) and temporary and long-term slopes (Section 4.5). As shown in Figure 6, geotechnical borings along the centerline of the construction roads are currently planned on 500-foot centers for Stations 13+00 to 60+50. Geotechnical borings within the Clean Zone

are currently planned on 250-foot centers given the additional data requirements for the slope stability analysis of this area. The above spacing may be adjusted in the field based on observed subsurface conditions.

The geotechnical sampling can be conducted with a small track mounted drilling rig to minimize disturbance of the area. However, some smaller trees along the construction road alignments will need to be cut at the ground surface to provide access for the track mounted rig. In order to support the above analyses, alternating borings on 500-ft centers will be drilled to a depth of approximately 15 feet below ground surface (bgs) and 30 feet bgs, respectively. The borings on 250-foot centers will be drilled to a depth of approximately 30 feet bgs. Continuous samples will be taken to approximately 10 feet below ground surface (bgs) and at approximately 5-foot depth intervals thereafter. It is assumed that isolation casing will not be necessary for these borings.

A thin-walled Shelby tube and/or Piston sampler will be used to collect relatively undisturbed samples of fine-grained cohesive soils in general accordance with ASTM D1587. Sampling of any sandy soils will include Standard Penetration Testing (SPT) using a 2-inch O.D. split-spoon sampler driven in general accordance with ASTM D1586.

Selected soil samples will be collected and analyzed for moisture content, Atterberg Limits, grain size, and unconfined compressive strength (UCS) to support the construction road design. Unconsolidated-undrained (UU) and consolidated-undrained (CU, with pore pressure measurements) triaxial compressive strength tests for selected undisturbed samples of cohesive, fine-grained soils will be performed to obtain 'undrained' and 'drained' shear strength parameters, respectively, for the slope stability analysis.

As previously discussed, borings will be backfilled in accordance with Section 5.6 of the *Construction of Geotechnical Boreholes and Groundwater Monitoring Systems Handbook* (LDEQ/LDOTD 2000).

#### **4.5 SLOPE STABILITY EVALUATION**

The potential for Bayou channel slope failures during remediation activities will be evaluated using geotechnical data acquired during the above investigation and the software PCSTABL 5M (under the pre- and post-processor STEDwin 2.78). While it is currently thought that the potential for slope failure is greatest for the Clean Zone during removal of

contaminated sediments, the slope stability analysis will also evaluate the potential for slope failure for the remainder of OU1.

Long-term and temporary conditions will be analyzed. The evaluation will consider current conditions; conditions after dewatering (with and without spoil banks left in place); conditions after sediment excavation (Stations 5+00 to 13+00) or in-place sediment solidification (Stations 13+00 to 60+50); and conditions after backfilling with clean materials (Stations 5+00 to 13+00) or addition of solidified soils/sediments from other areas (Stations 13+00 to 60+50), and capping.

#### **4.6 BENCH SCALE TREATABILITY STUDY**

A bench scale treatability study of Bayou Trepagnier sediments/soils will be conducted to determine the strength and volume gain corresponding to various percentages of selected reagents. The laboratory will prepare a range of mix ratios for evaluation. Samples will be prepared by hand mixing and placing the material in molds. After compaction, the mixes will be capped and allowed to cure in the laboratory. Strength testing will occur at periodic intervals (e.g., 3, 7, 14, and 28 days).

Hand penetrometer tests, which provide an estimate of unconfined compressive strength, will be performed on each mixture after curing for the specified time periods. The resulting plots of unconfined compressive strength versus mix ratio will be used, in conjunction with the field pilot study, to determine preferred reagents and desirable mix ratios.

#### **4.7 CONTRACTOR CONSTRUCTABILITY REVIEWS**

Upon completion of the above data gap analyses, constructability reviews will be solicited from one or more remediation contractors identified as potential bidders by Motiva for the OU1 Final Remedy. The constructability reviews will focus on the following issues:

- Potential conceptual design conflicts;
- Physical limitations of the work site;
- Construction road and water management options;
- Construction sequencing and coordination;
- Site support and staging areas;
- Site safety and security;

- Equipment, material, and labor availability;
- Environmental impacts from construction activities;
- Schedule; and
- Cost.

The contractors may identify additional data gaps requiring evaluation as a part of their constructability reviews. For example, contractors may propose to perform their own bench scale treatability studies using proprietary mixtures of reagents.

#### **4.8 FIELD PILOT SCALE STUDY/DEMONSTRATION**

The reagent mix ratios tested in the bench scale treatability study(s) will be further tested in a field pilot study by one or more remediation contractors to help adjust mix ratios for field conditions. Other issues to be evaluated in a field pilot study would include: (1) testing of specific remediation equipment under field conditions; (2) options for building construction roads; and (3) sediment dewatering and water management practices.

The proposed schedule for the OU1 Remedial Design is as follows (see Figure 8):

- Motiva will submit this OU1 Remedial Design to the LDEQ within 120 calendar days of the effective date of the Cooperative Agreement (i.e., by June 13, 2008);
- Motiva will collect and evaluate data identified in Section 4 of this document;
- Motiva will submit the OU1 Remedial Project Plan to the LDEQ within 60 calendar days of completion of the OU1 data gap evaluation.

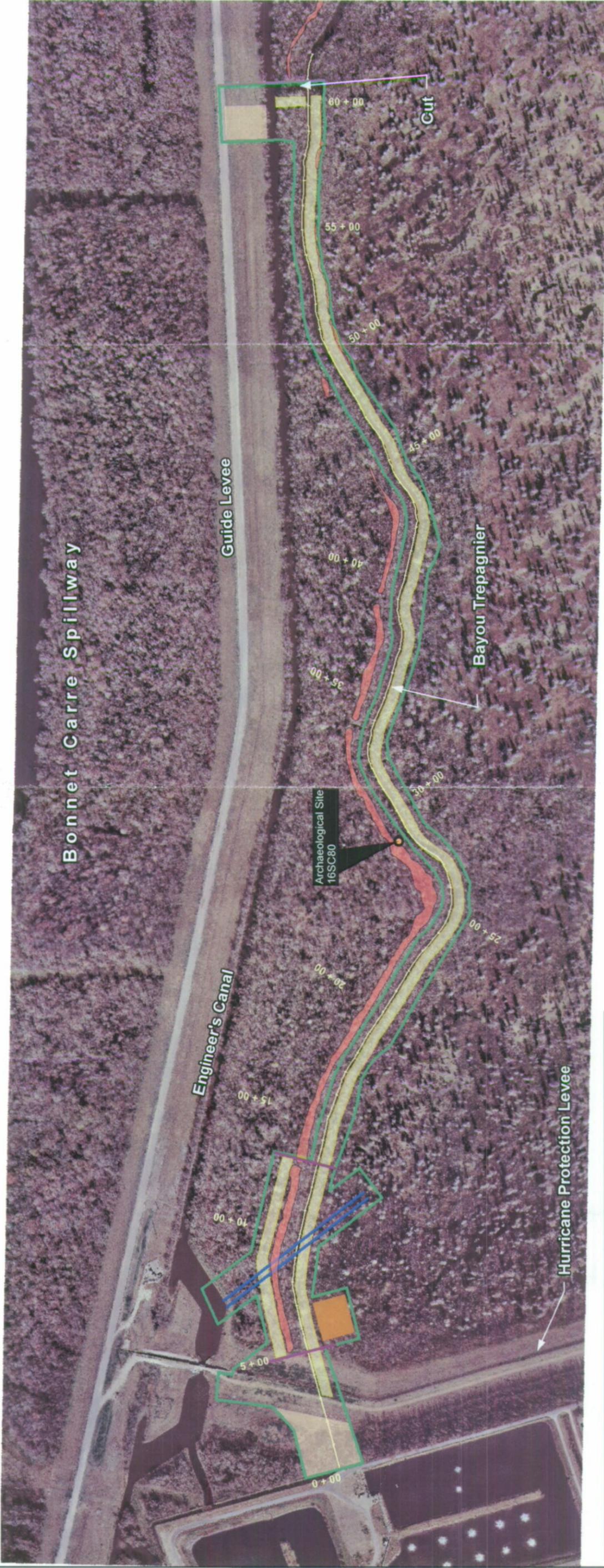
The time required to collect the OU1 data is dependent on several factors, including receipt of LDNR and USACE permits, weather delays, contractor availability, and identification of any additional data gaps. In accordance with Section XVII of the Cooperative Agreement, Motiva will continue to provide monthly project updates to the LDEQ, which will include both a summary of recent activities as well as an update on the projected completion date for the OU1 data gap evaluation.

- Evans Jr., J.P. 2002. Bayou Trepagnier Located within Section 27 of T12S-R8E, St. Charles Parish, Louisiana. August 22, 2002 letter report from State of Louisiana, State Land Office to C-K Associates, Inc.
- Kelley, David B. 2008. Intensive Cultural Resource Survey of Bayou Trepagnier Between Station 5+00 and Station 115+00, St. Charles Parish, Louisiana. *Addendum A: Delineation of the Eastern Boundary of Archaeological Site 16SC80*. Coastal Environments, Inc.
- Louisiana Department of Environmental Quality (LDEQ) and Louisiana Department of Transportation and Development (LDOTD) 2000. Construction of Geotechnical Boreholes and Groundwater Monitoring Systems Handbook. December 2000.
- Louisiana Department of Environmental Quality (LDEQ) 2007. The Louisiana Department of Environmental Quality's Decision Document for the Final Remedy of Bayou Trepagnier Upper Reach (Operable Unit 1), Agency Interest #44765. August 6, 2007.
- Louisiana Department of Environmental Quality (LDEQ) 2008. Cooperative Agreement for Site Investigation and Remediation Between the State of Louisiana Department of Environmental Quality and Motiva Enterprises, LLC in the matter of the Bayou Trepagnier Site, AI #44765. February 14, 2008.
- Motiva Enterprises, LLC (Motiva). 2006. Bayou Trepagnier Feasibility Study Supplement II, Upper Reach (Operable Unit 1). Agency Interest No. 44765. November 2006 (Revision 1).
- Motiva Enterprises, LLC (Motiva) 2008. RECAP Management Option 3 Work Plan, Bayou Trepagnier Operable Unit 2, AI # 44765. February 14, 2008 (Revision 0).

**FIGURES**





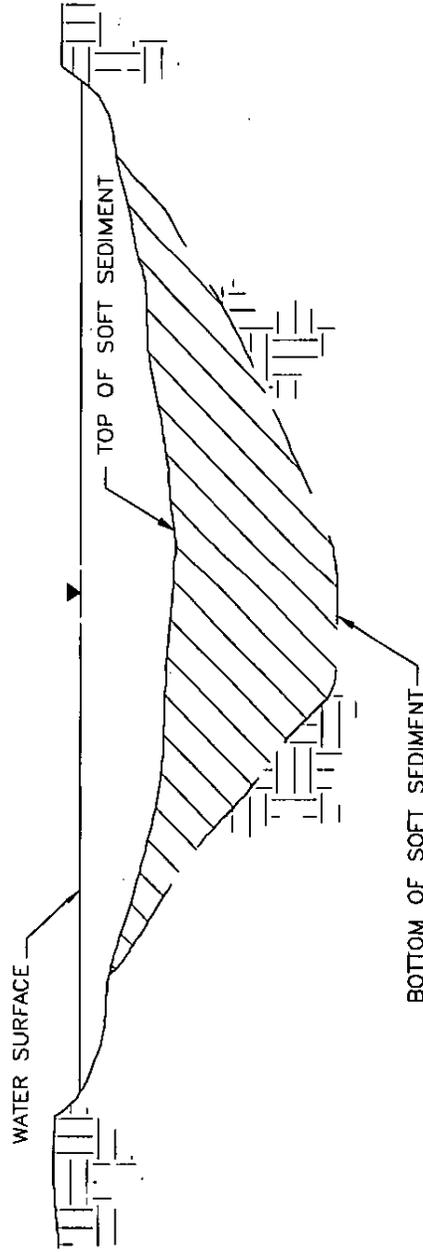


**MOTIVA**  
ENTERPRISES LLC

**URS**  
7388 Florida Blvd  
Baton Rouge, LA 70806  
225/622-5700

**Figure 3**  
**Site Plan**  
OU1 Remedial Design





PROJ. NO.  
25009269

FIG. NO.  
4

CONCEPTUAL BAYOU CROSS SECTION  
CURRENT CONDITIONS  
OUI REMEDIAL DESIGN

**URS**  
7389 Florida Blvd., Suite 300  
Baton Rouge, Louisiana 70806  
225/822-5700

SCALE: --- N.T.S. ---

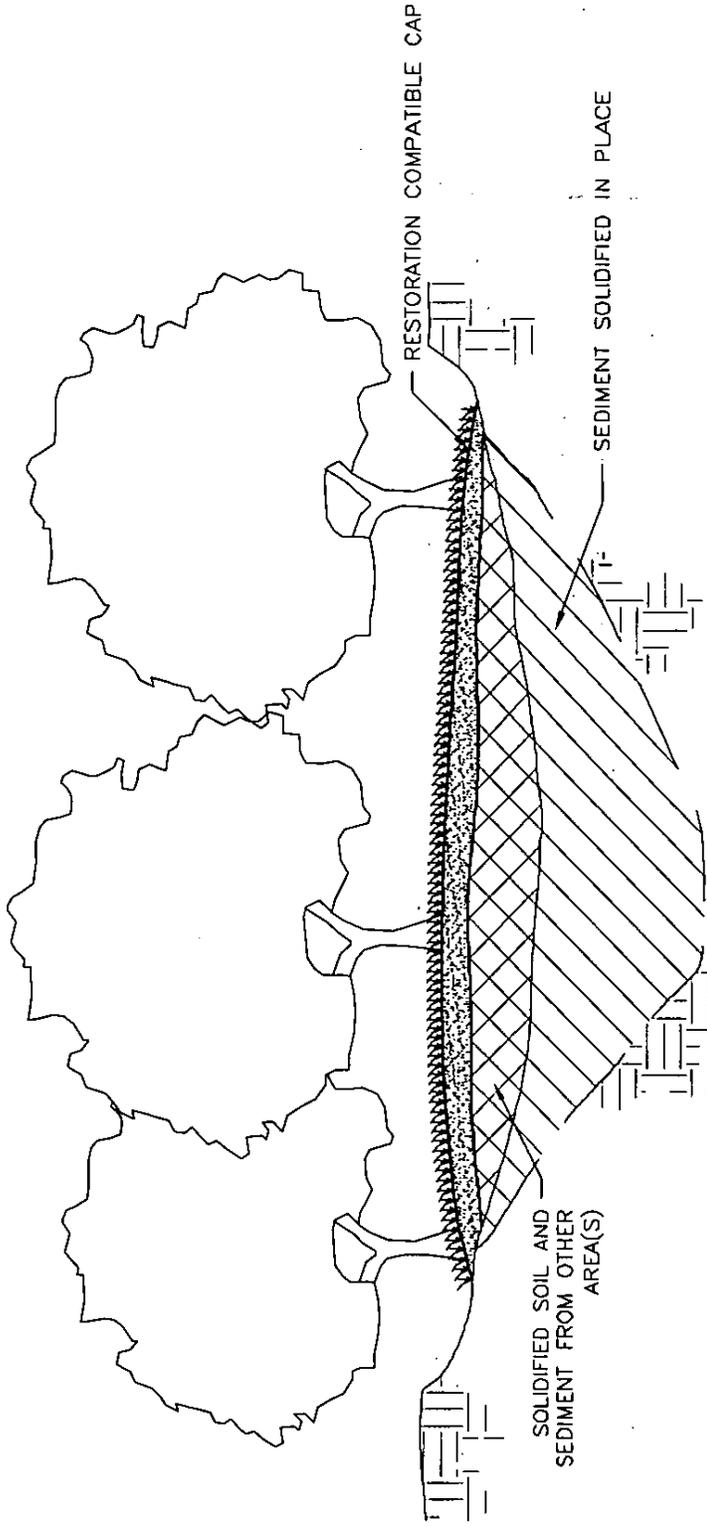
DATE: 05/28/08

DATE: 05/28/08

DRAWN BY: DB

CHKD. BY: CW

**MOTIVA**  
ENTERPRISES LLC



**NOTE:**

FINAL ELEVATIONS FROM STATIONS 13+00 TO 60+50 TO BE BASED UPON VOLUME OF SOIL / SEDIMENT EXCAVATED FROM CLEAN ZONE AND ANY ADDITIONAL MATERIAL IDENTIFIED IN O&M MO-3 EVALUATION.

**URS**

7389 Florida Blvd., Suite 300  
Baton Rouge, Louisiana 70806  
225/922-5700

SCALE:  
N.T.S.

DRAWN BY: DB  
CHKD. BY: CW

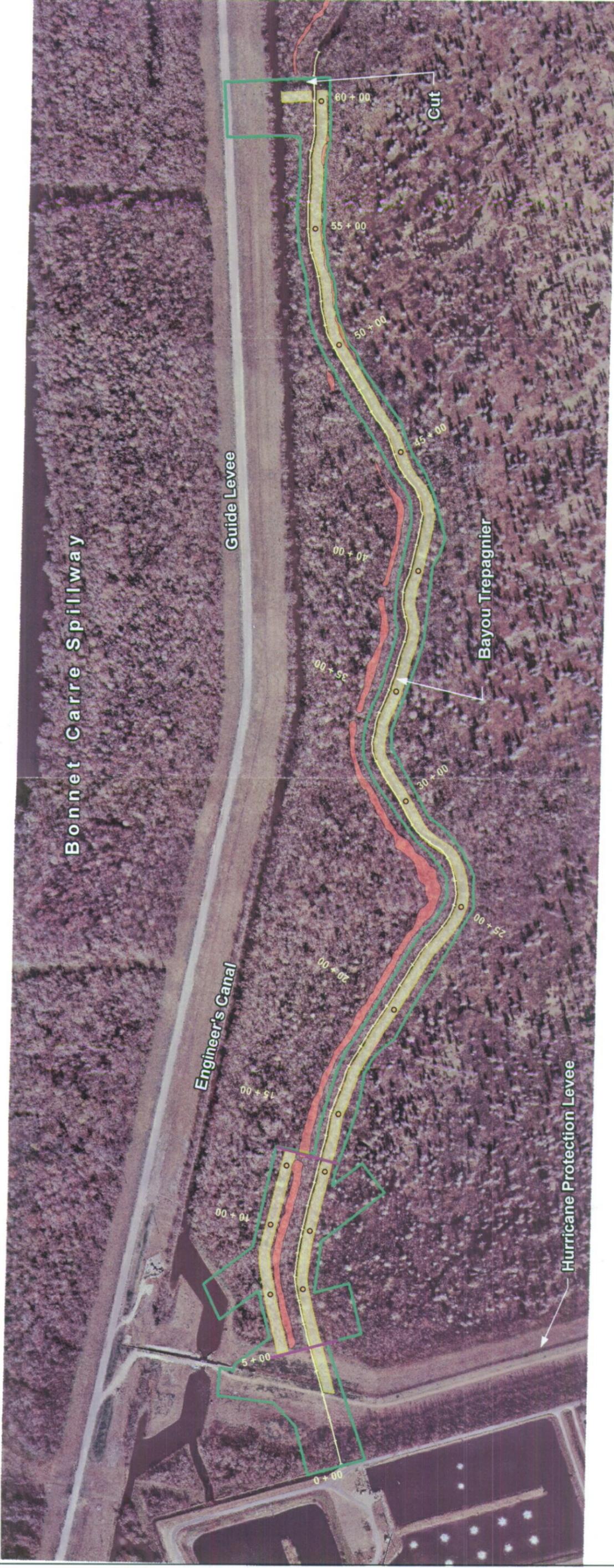
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DATE: 05/28/08

**MOTIVA**  
ENTERPRISES LLC

CONCEPTUAL BAYOU CROSS SECTION  
FUTURE CONDITIONS (STATIONS 13+00 TO 60+50)  
O&M REMEDIAL DESIGN

PROJ. NO.  
25009269

FIG. NO.  
5



**Legend**

- Clean Zone Limit
- Project Limit
- Bayou Trepagnier Centerline
- Spoil Banks
- Temporary Road
- Geotechnical Boring

North Arrow

0 200 400 Feet

Image Source: 2003 Gulf Coast Aerial Mapping

**MOTIVA**  
ENTERPRISES LLC

**URS**

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Baton Rouge, LA 70806  
225/922-5700

**Figure 6**

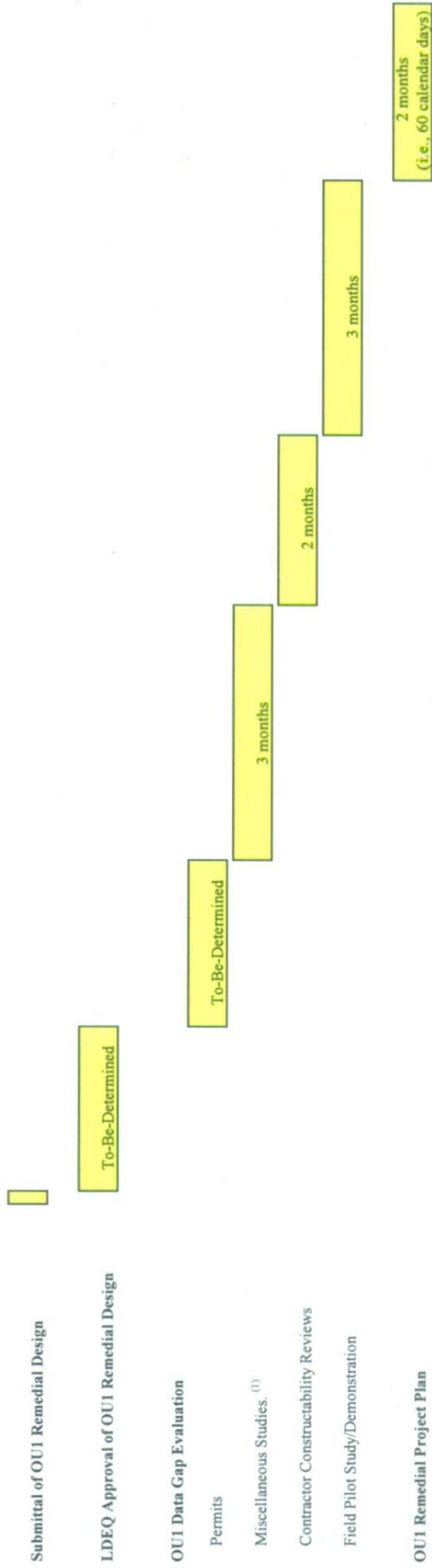
**Geotechnical Borings**

OU1 Remedial Design





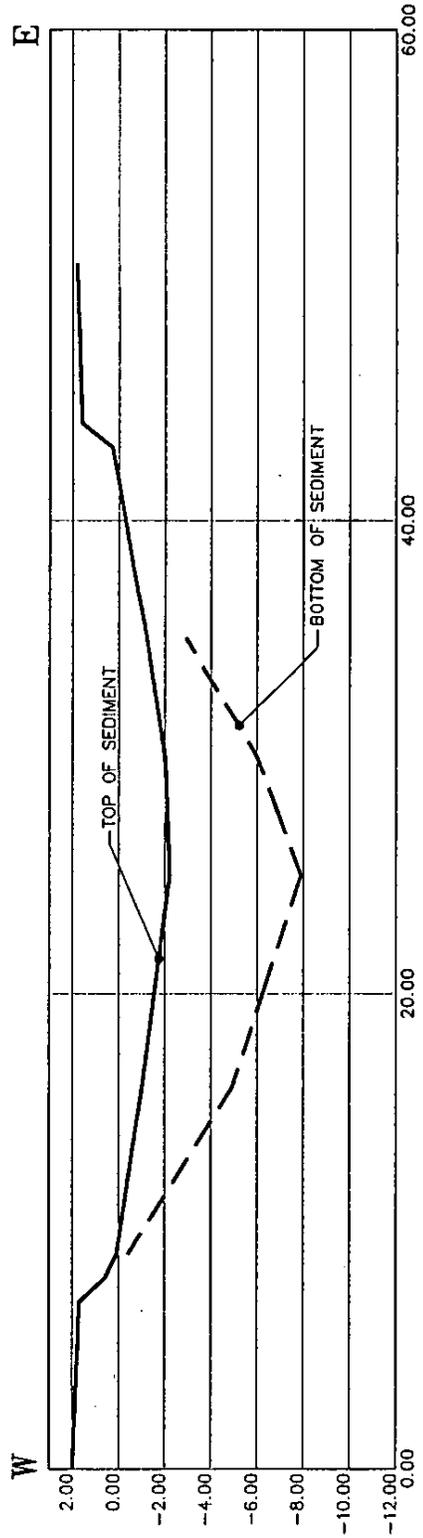
**Figure 8**  
**OU1 Remedial Design Schedule**



<sup>(1)</sup> Per Section 4 of the OU1 Remedial Design, Miscellaneous Studies consists of vertical delineation of the Clean Zone, probing of sediment thickness to confirm current conditions, soil background determination, geotechnical investigation, slope stability analysis, and bench scale treatability testing.

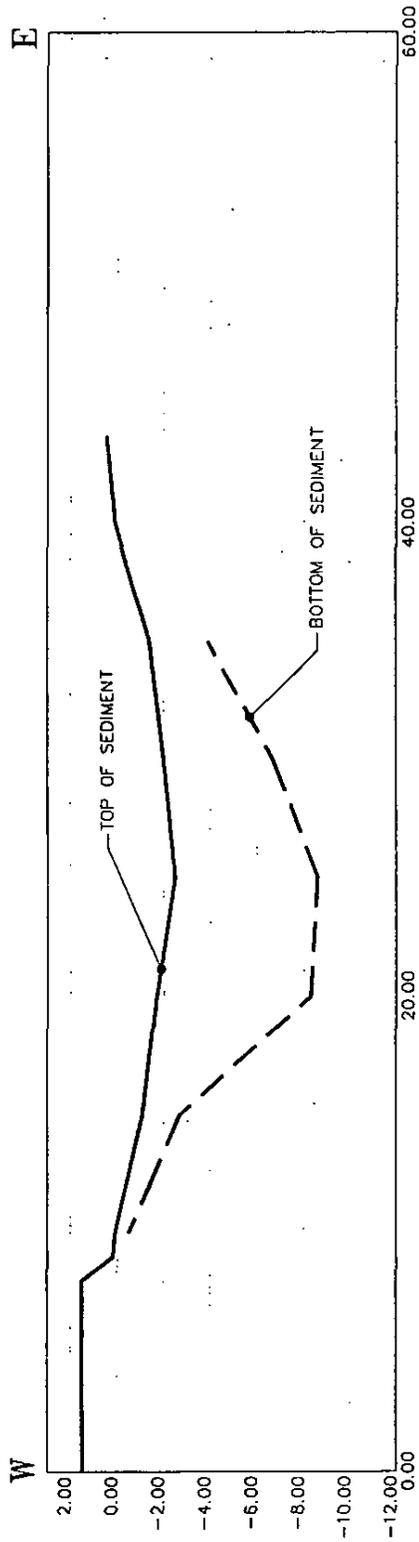
**APPENDIX A**

**EXISTING OU1 CROSS SECTIONS (STATIONS 5+00 TO 60+00)**



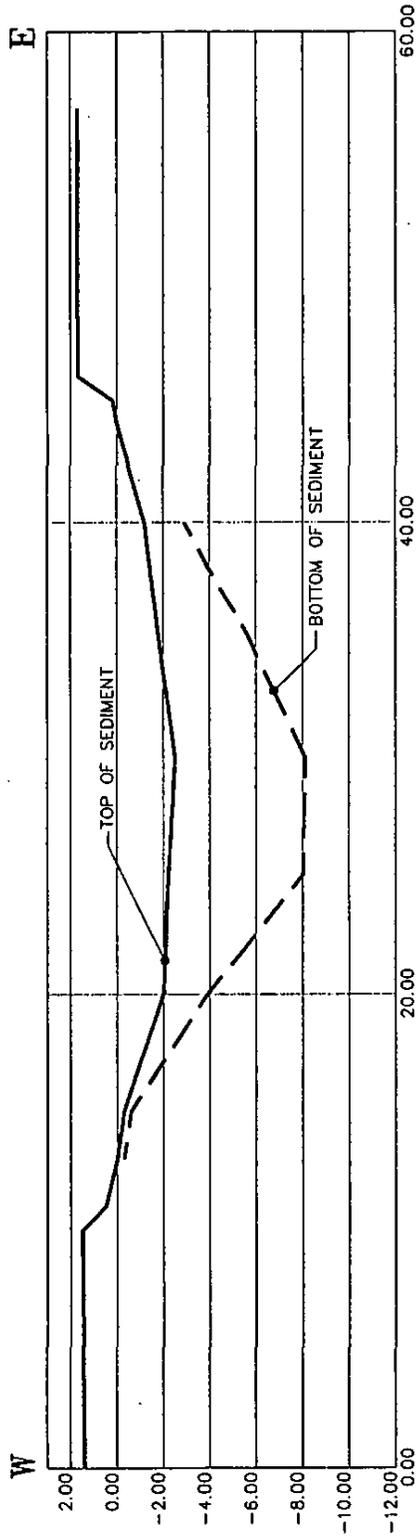
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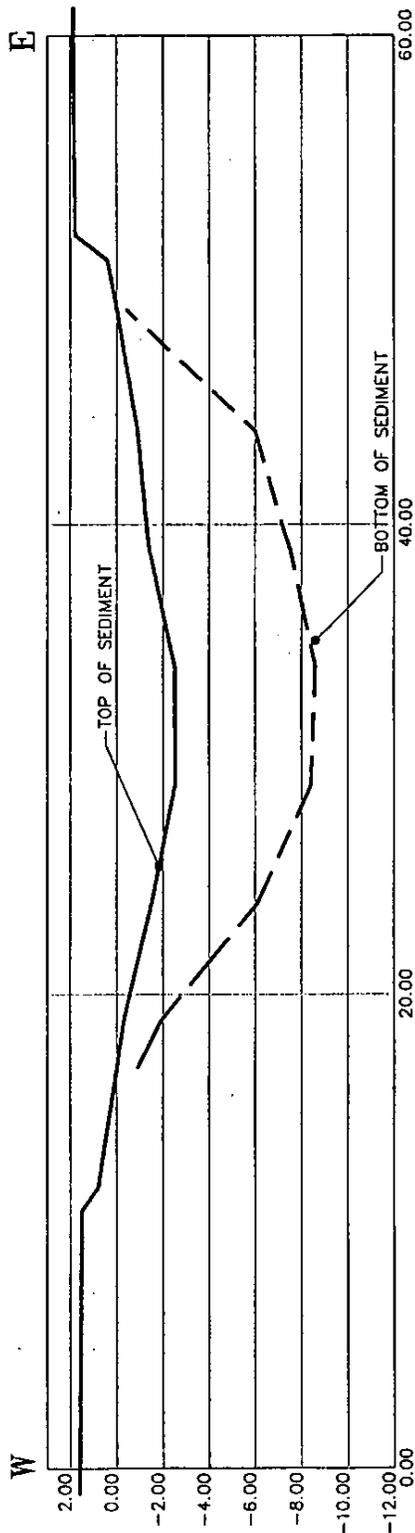
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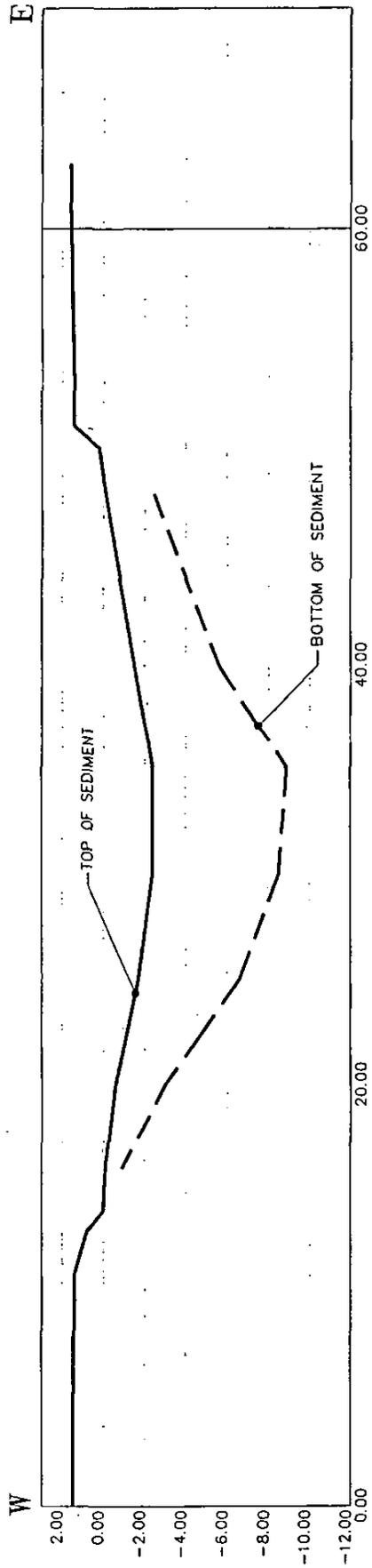
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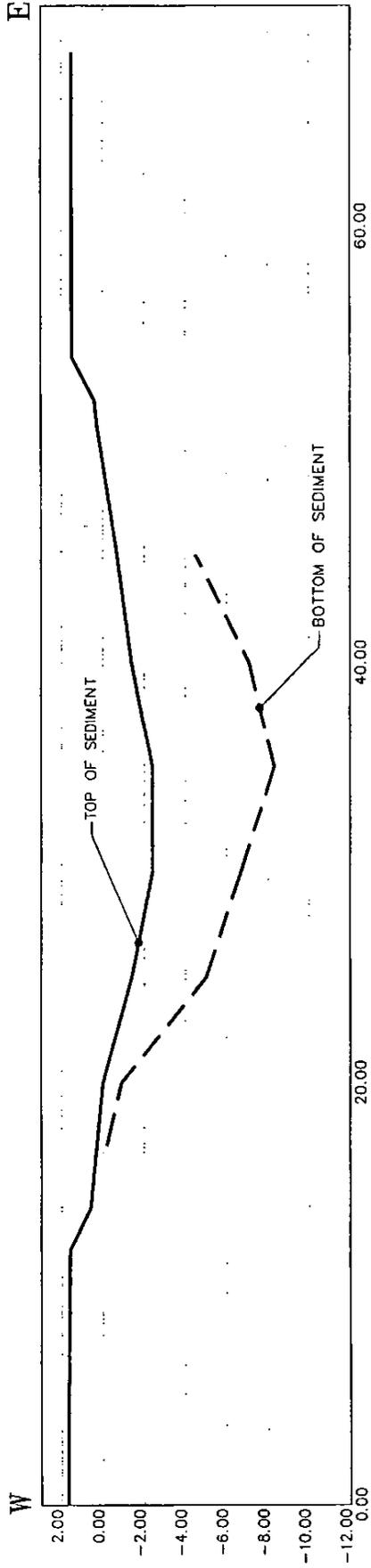
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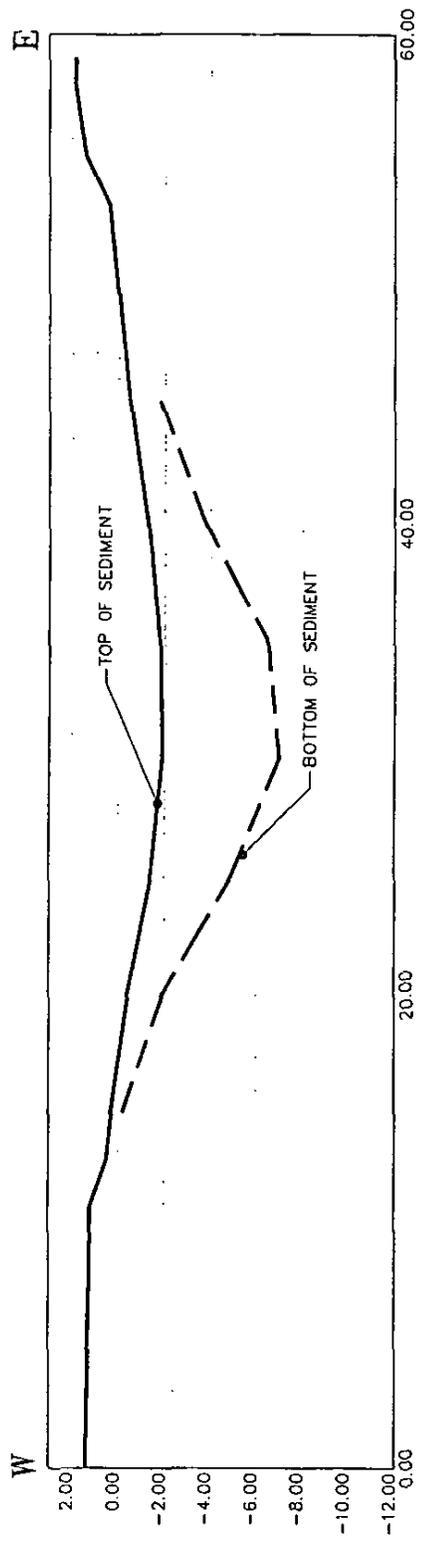
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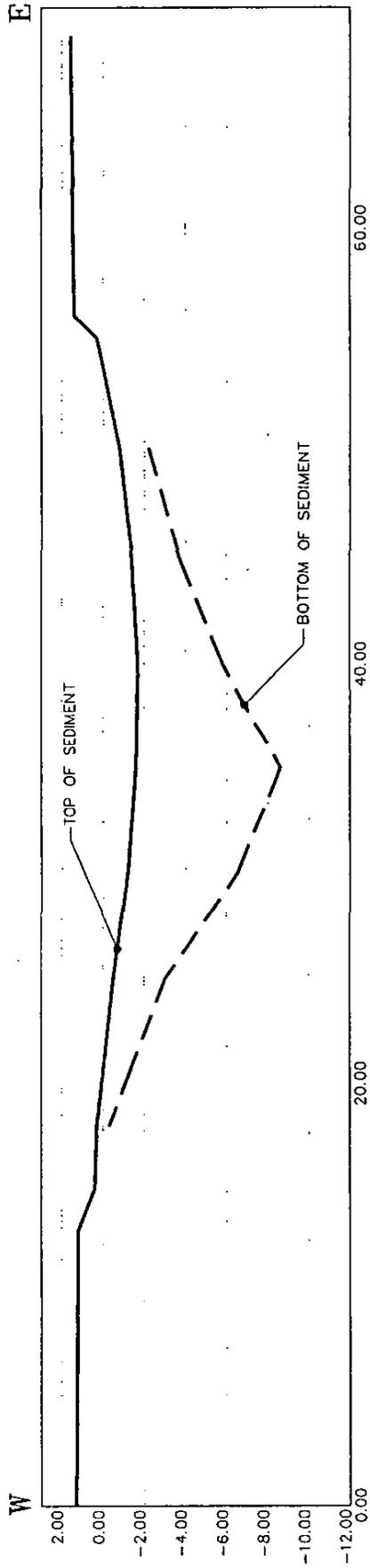
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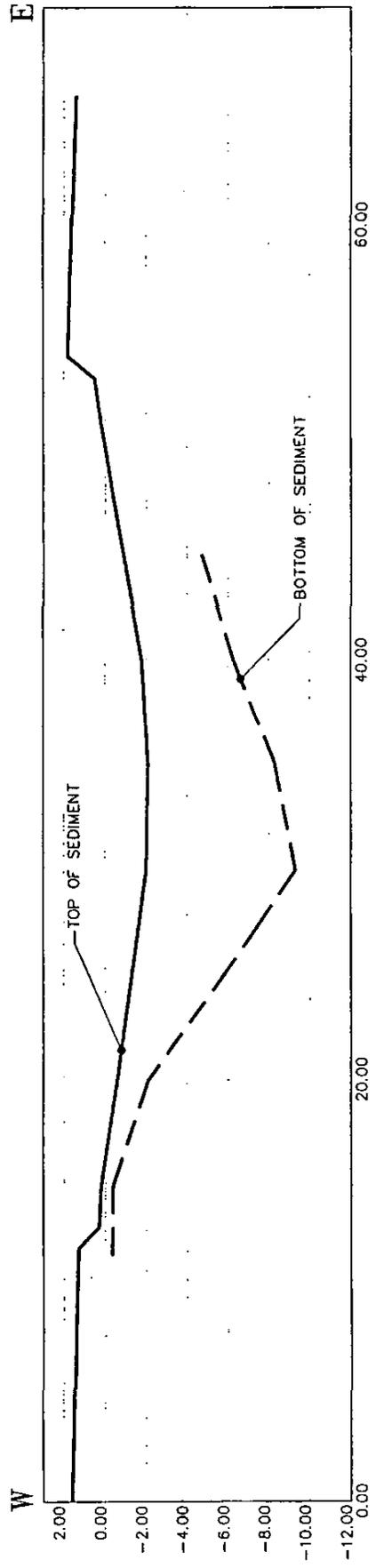
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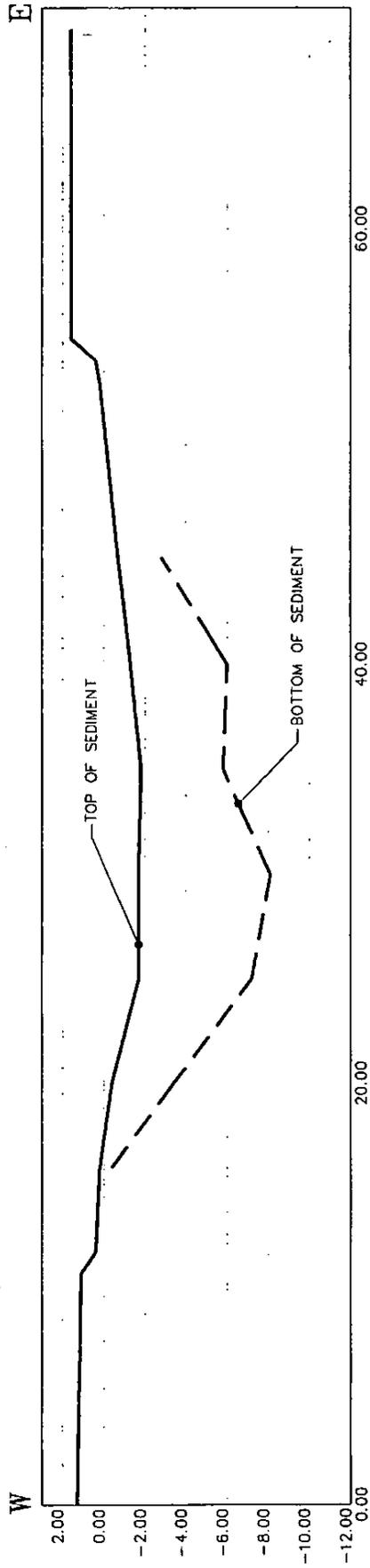
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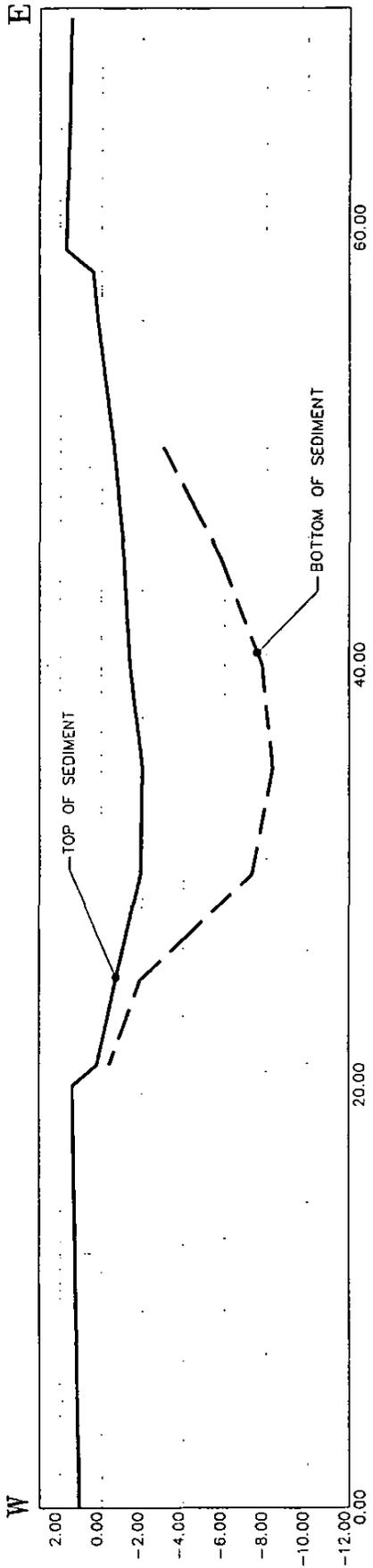
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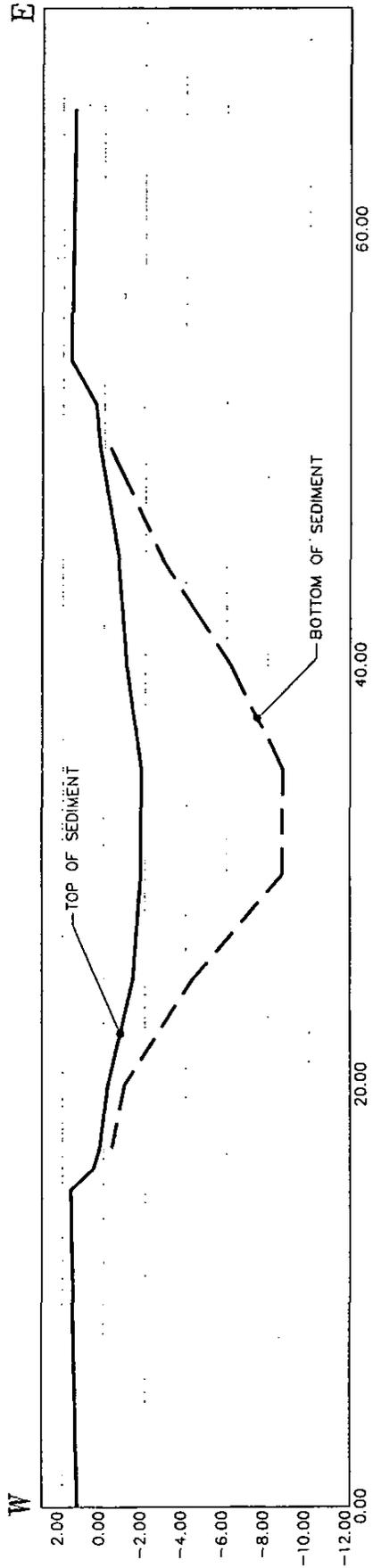
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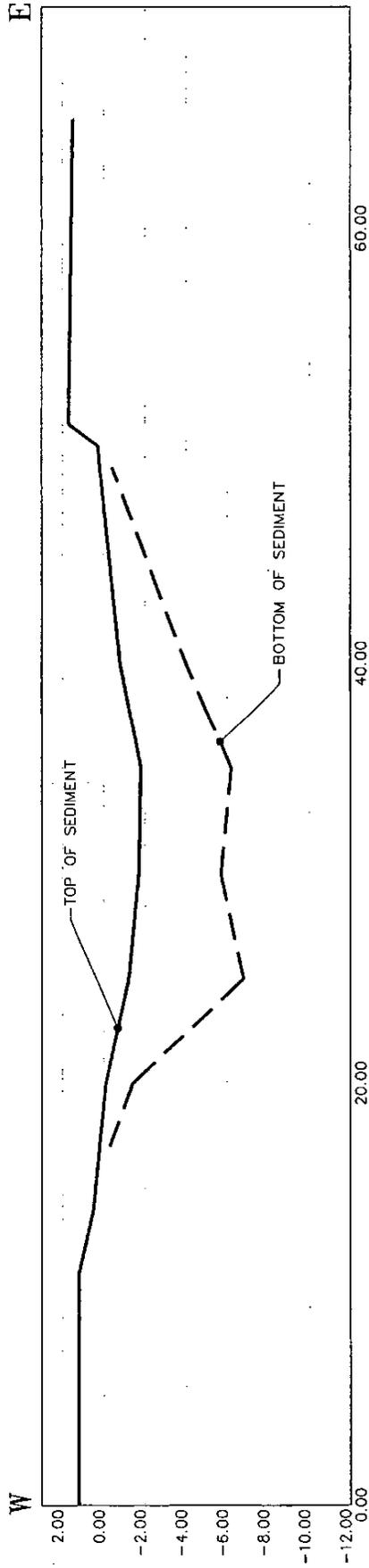
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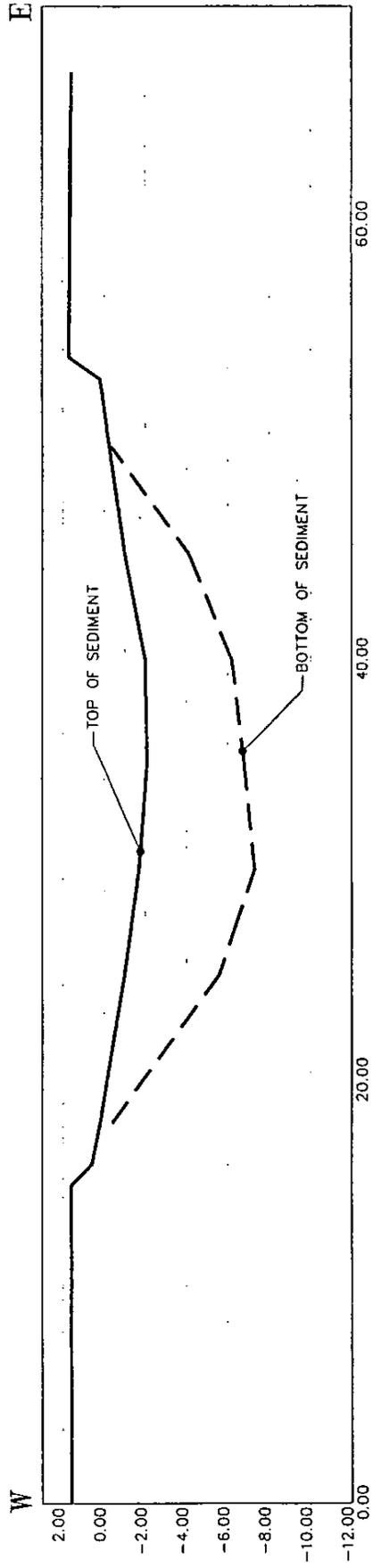
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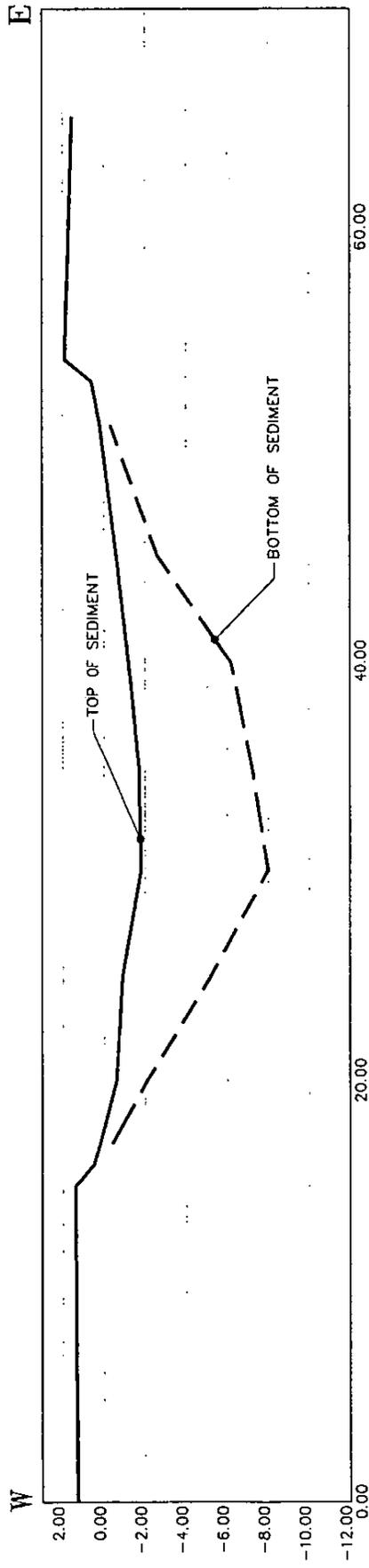
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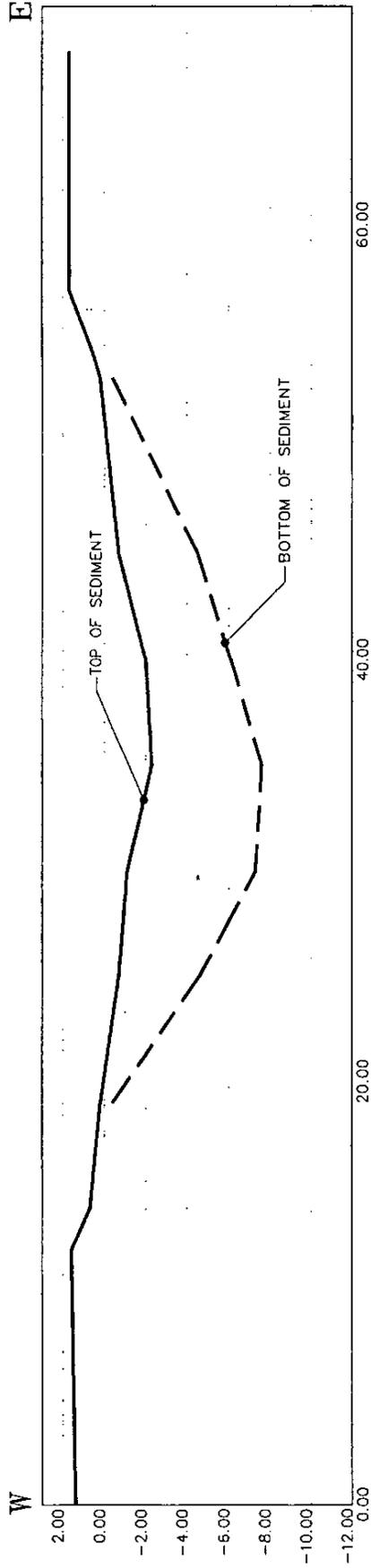
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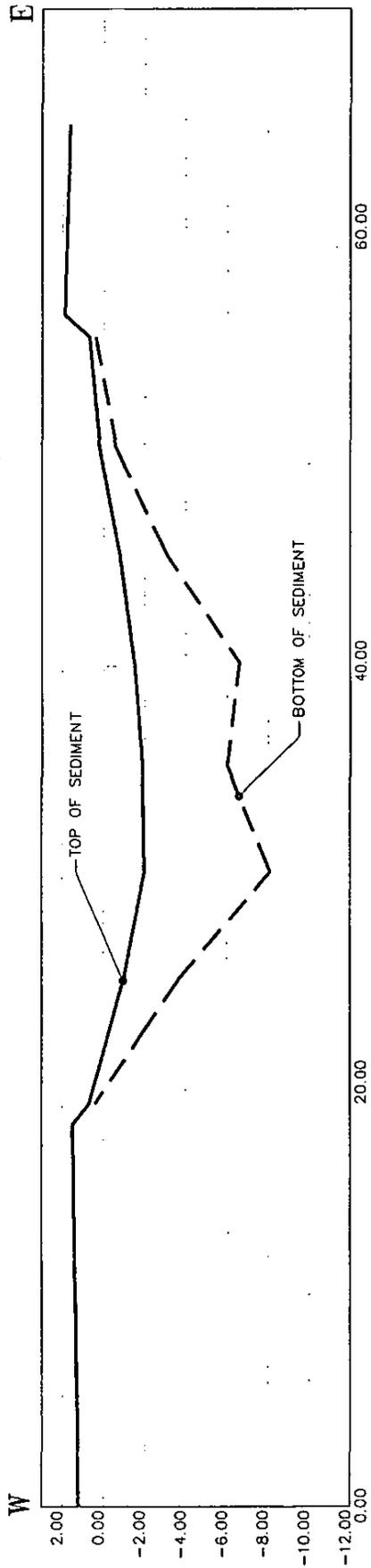
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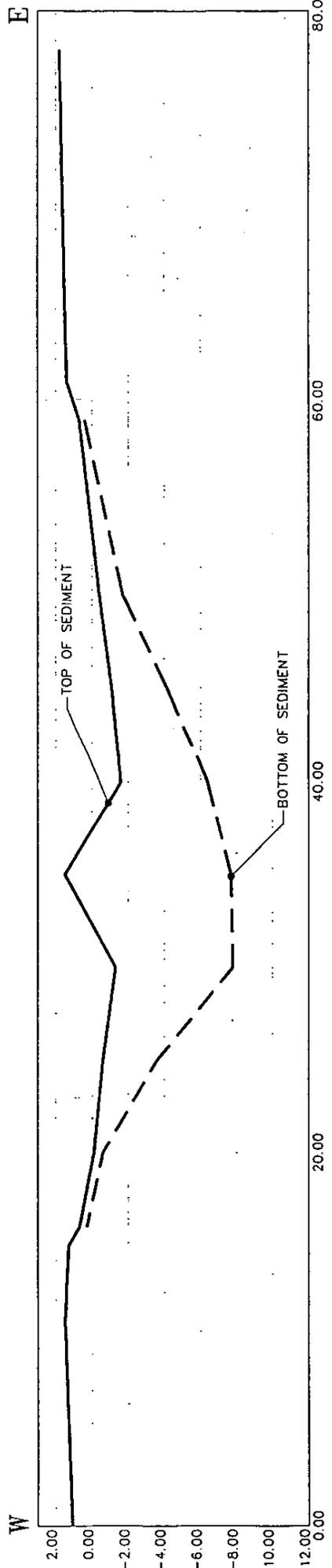
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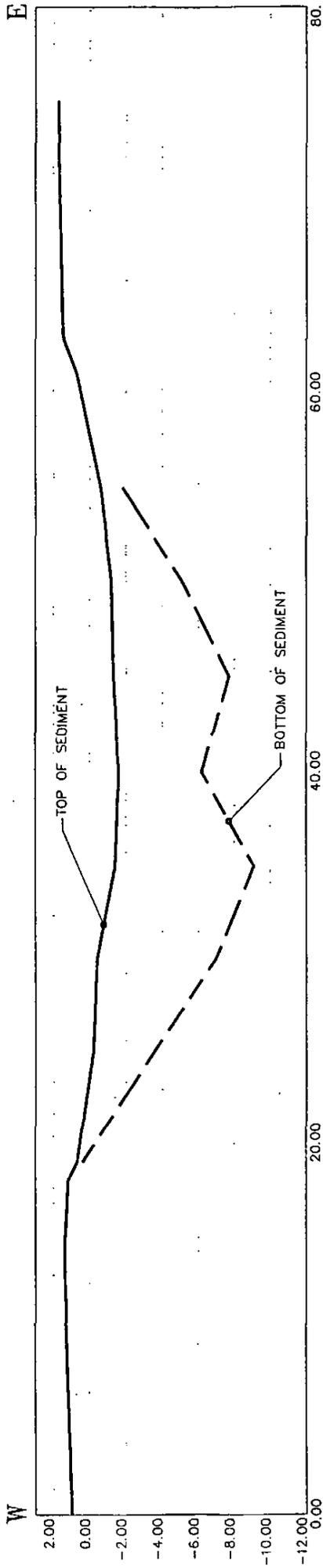
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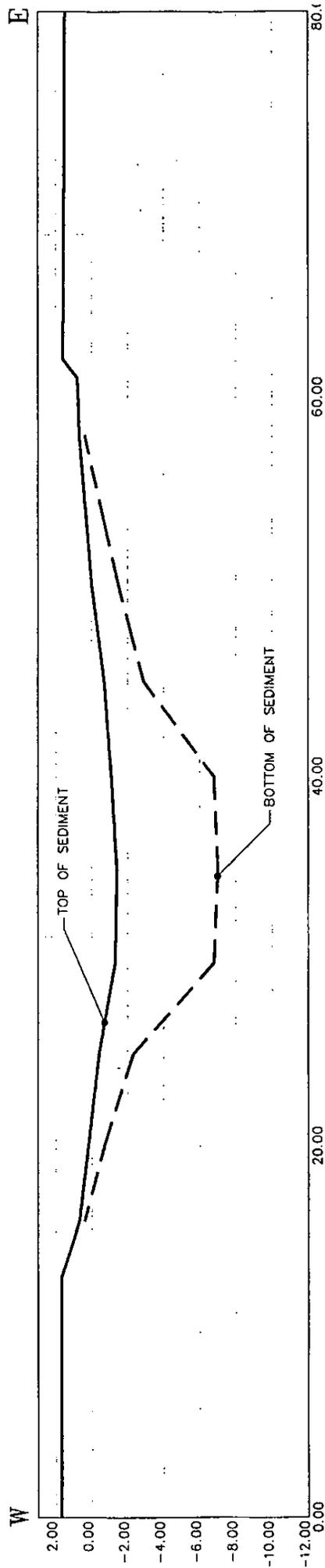
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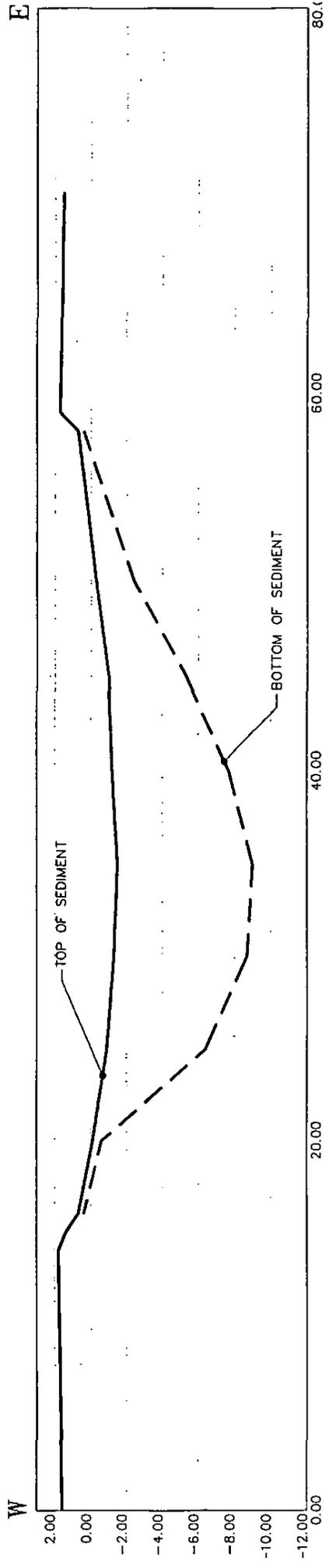
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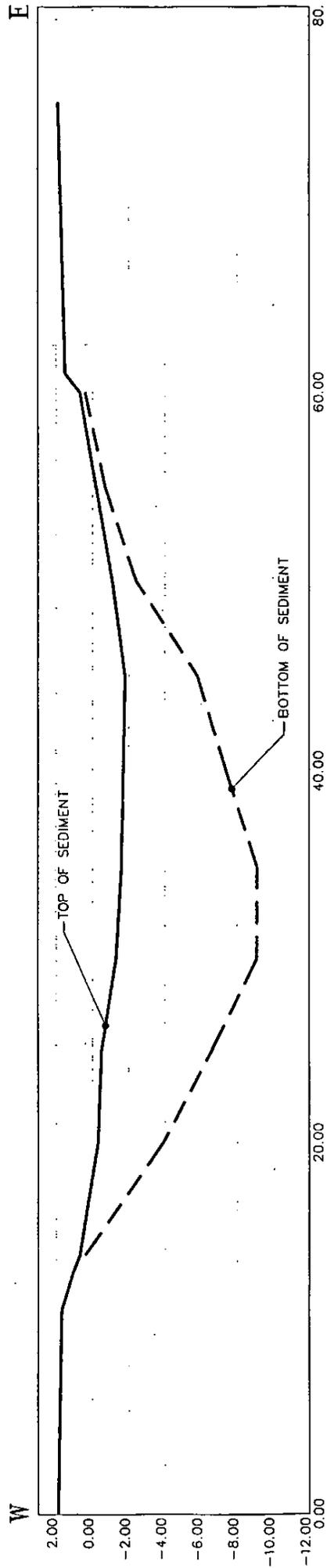
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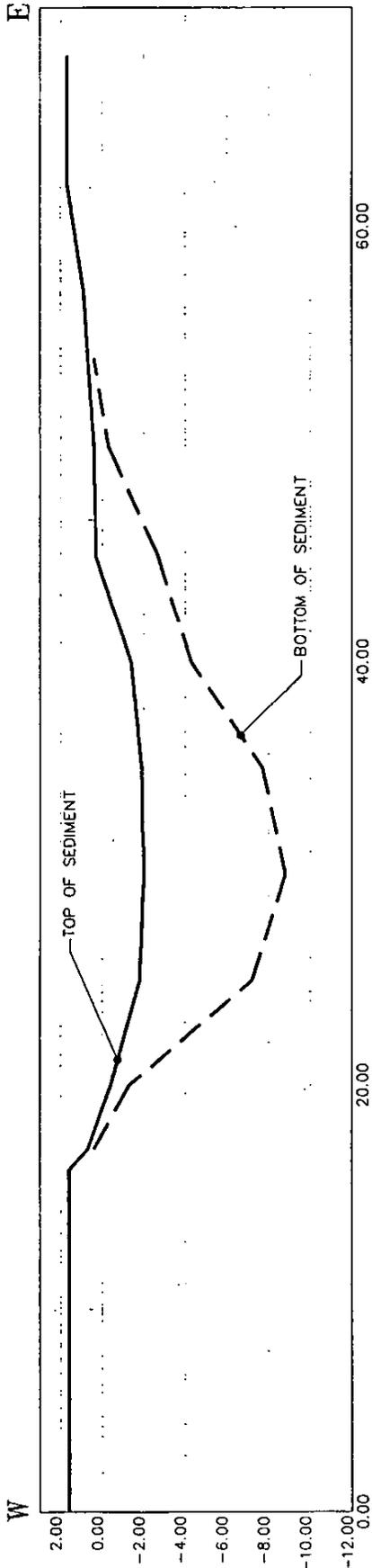
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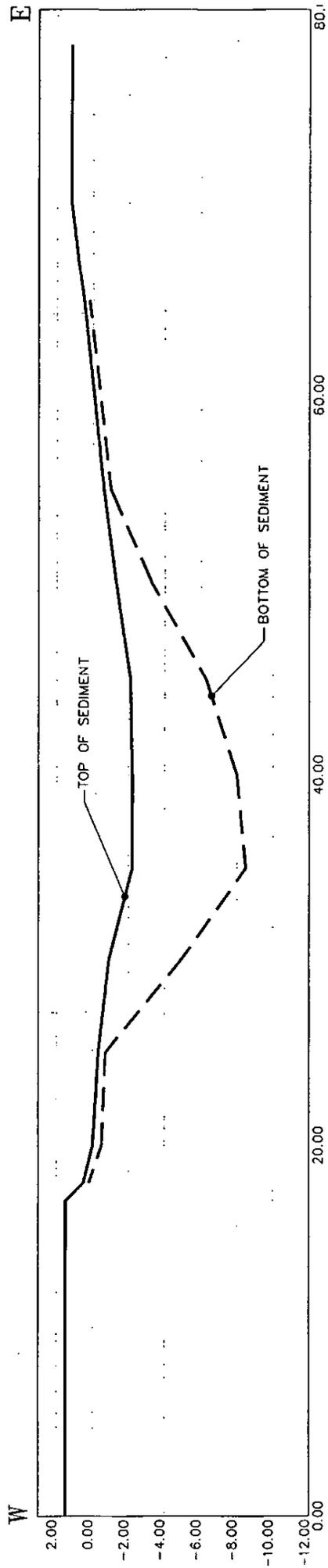
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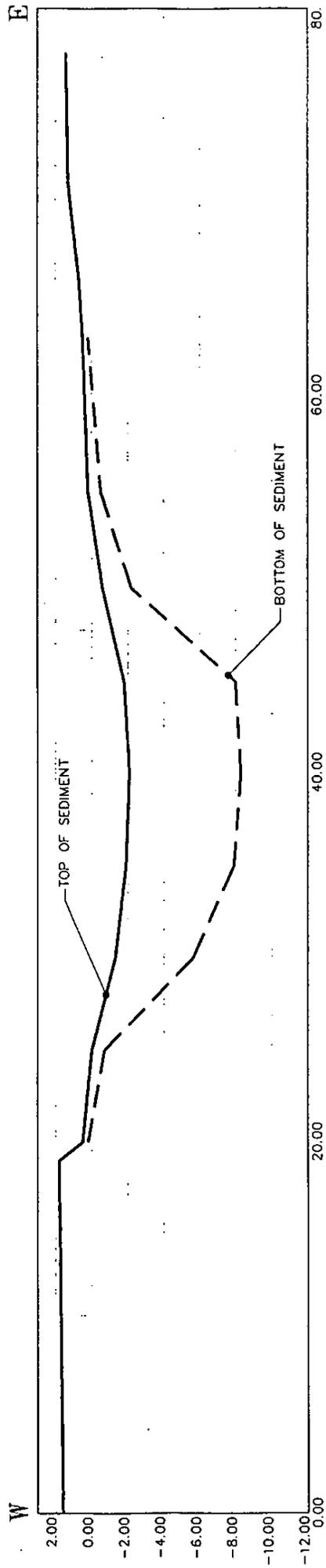
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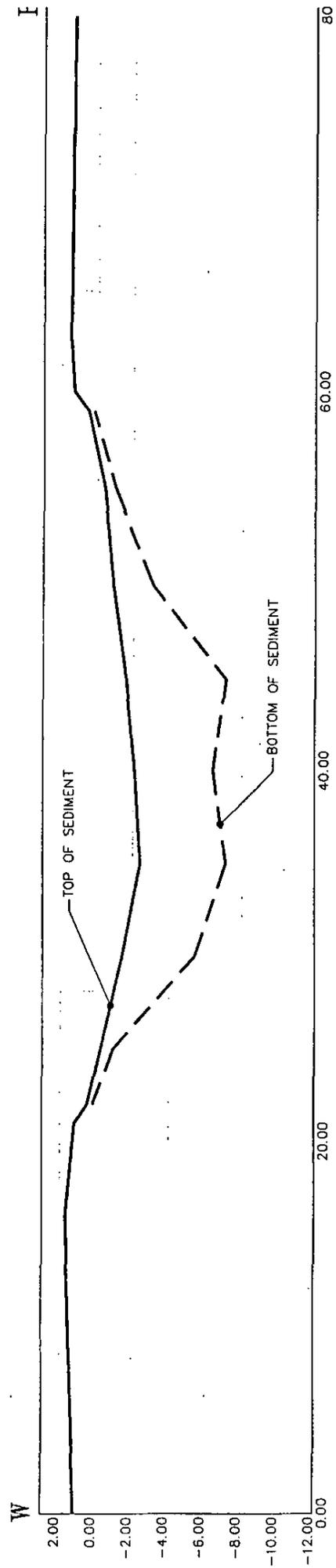
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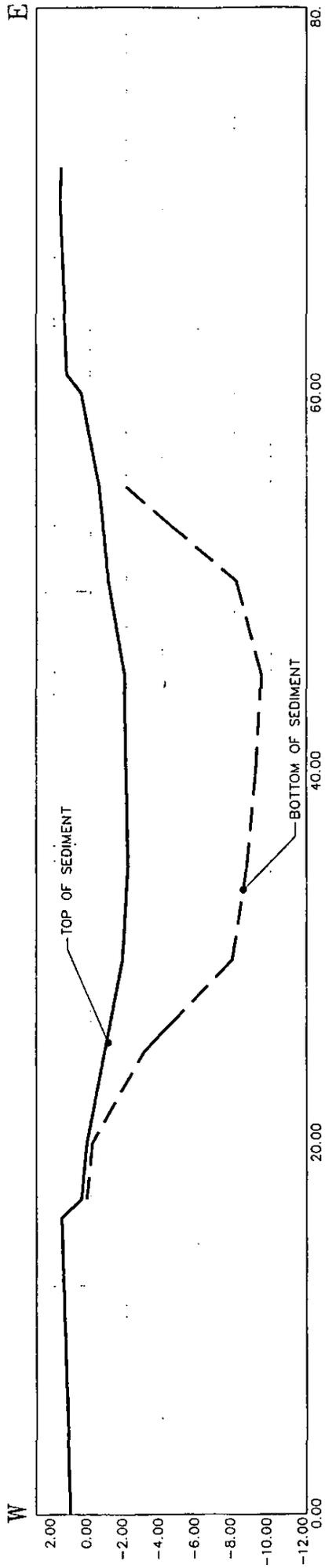
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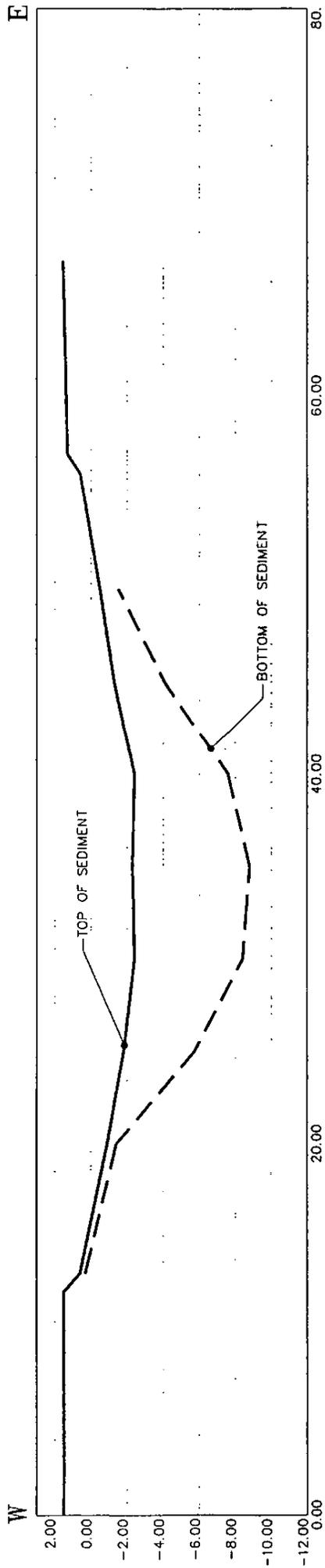
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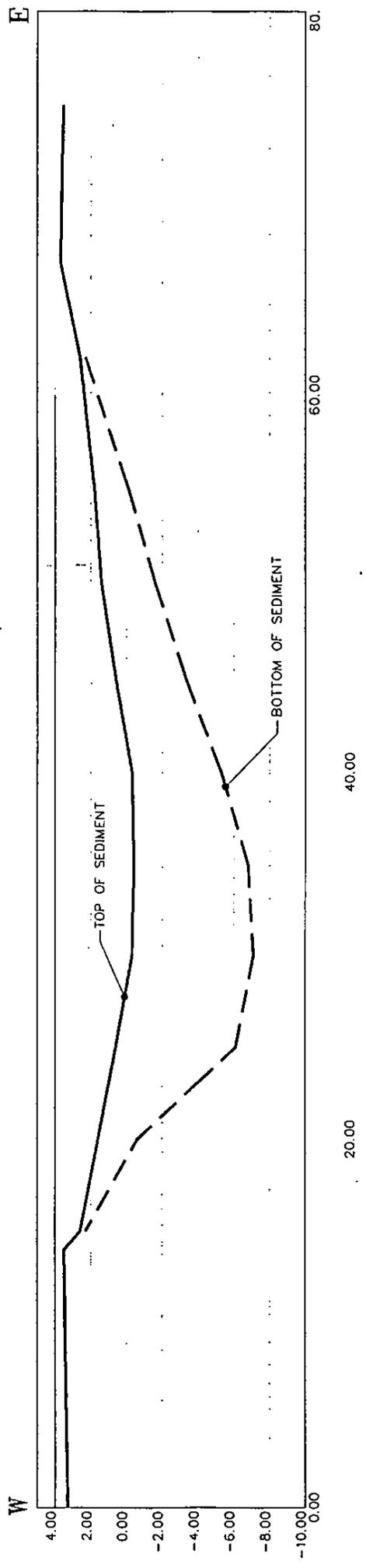
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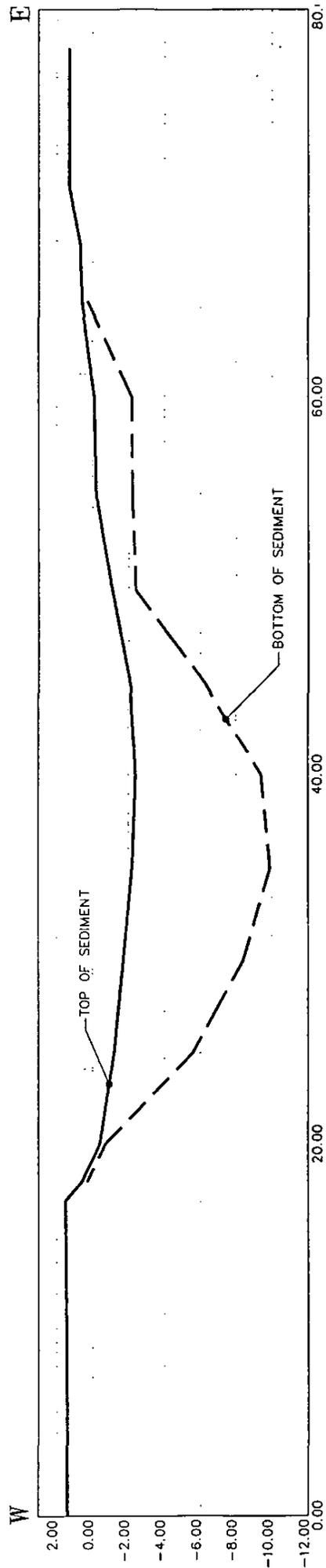
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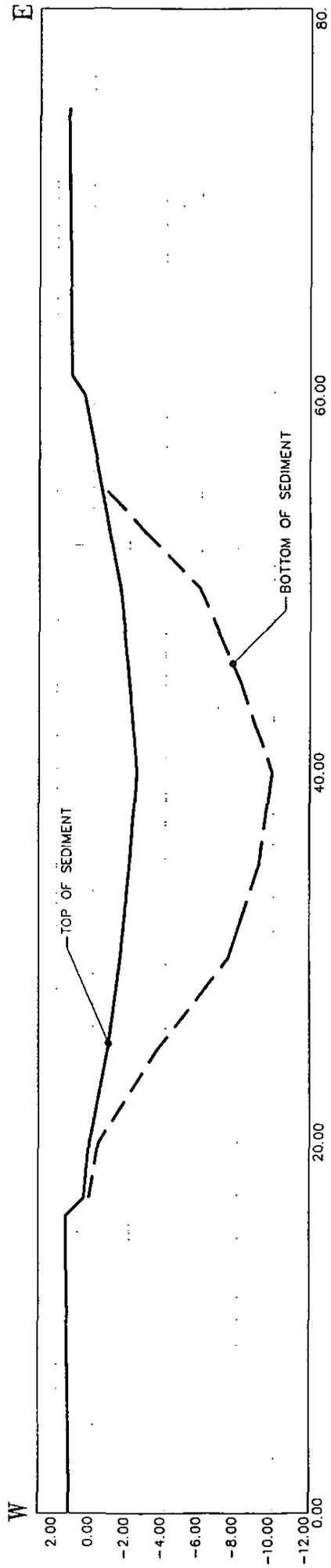
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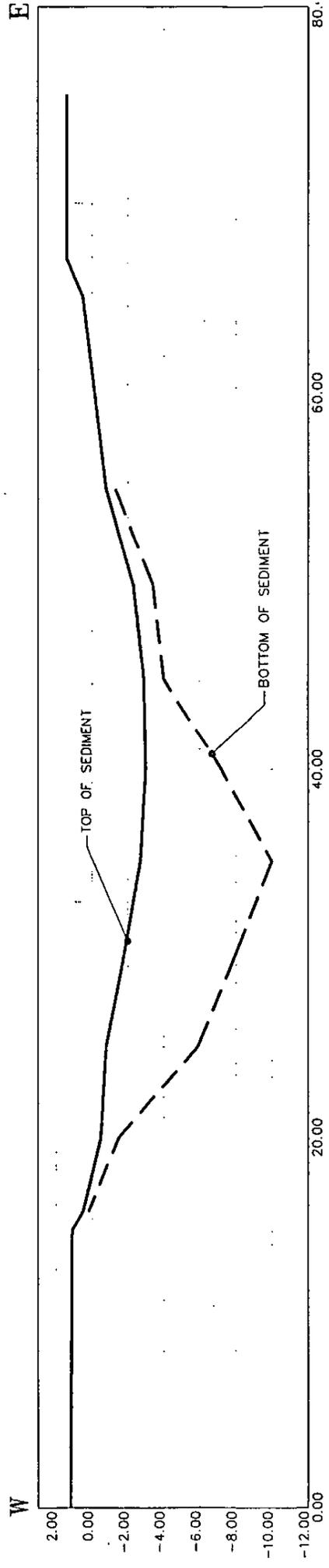
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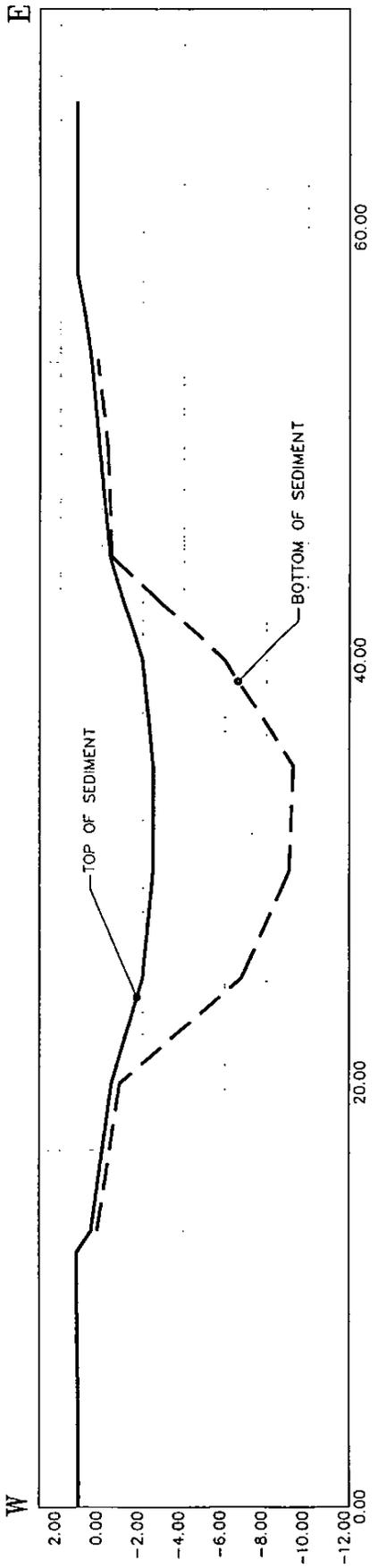
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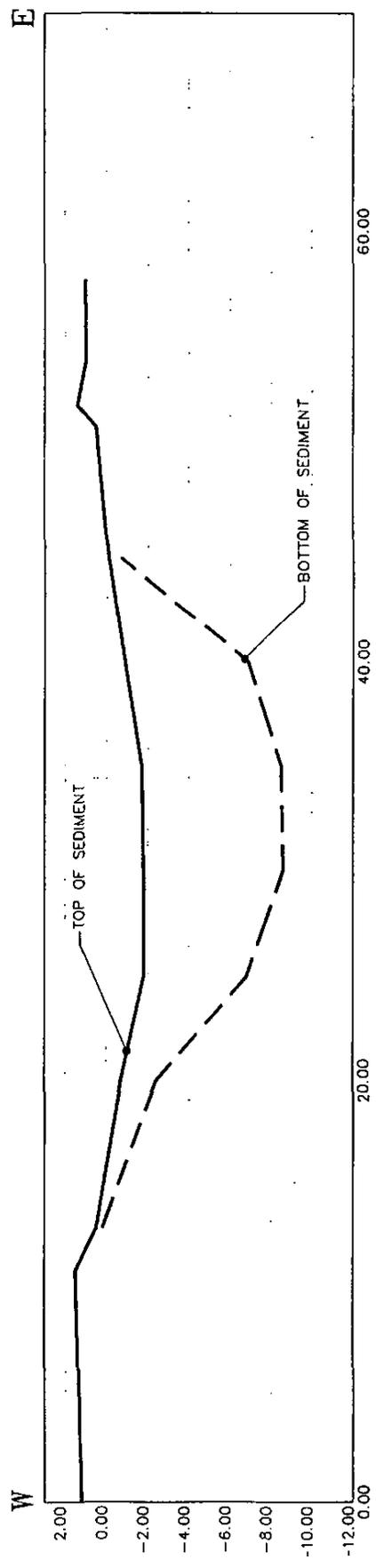
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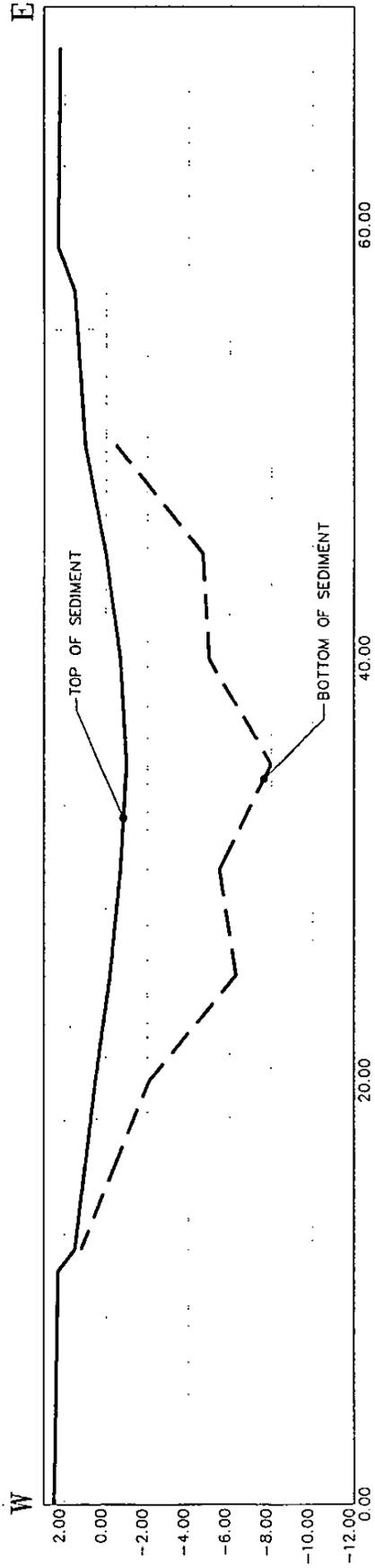
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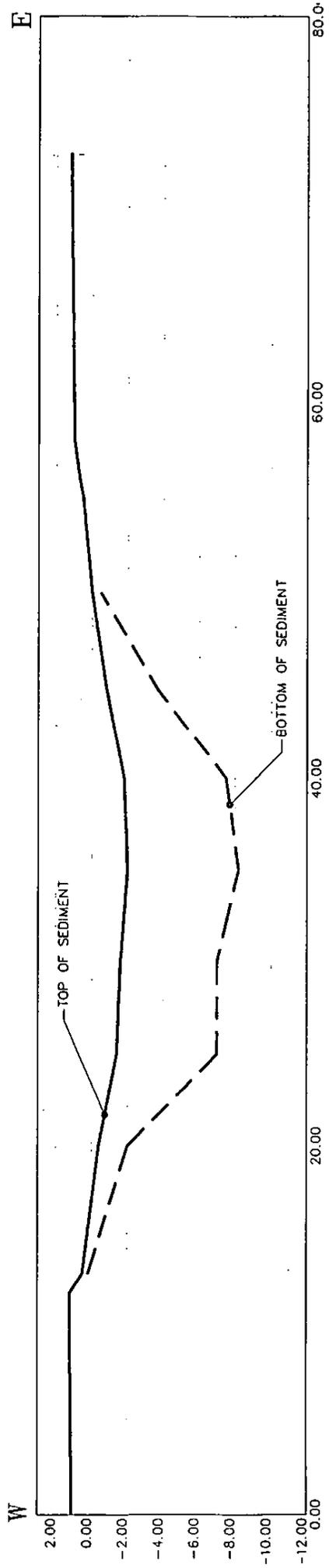
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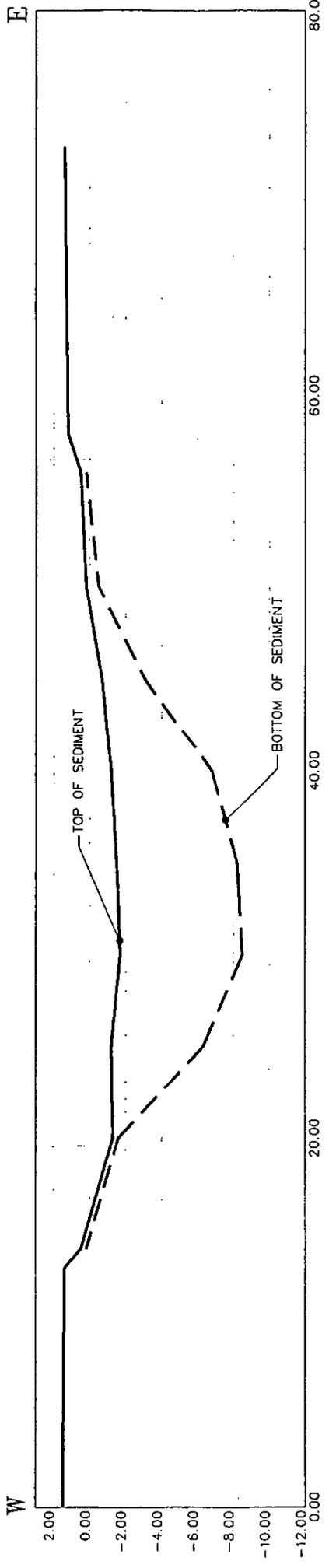
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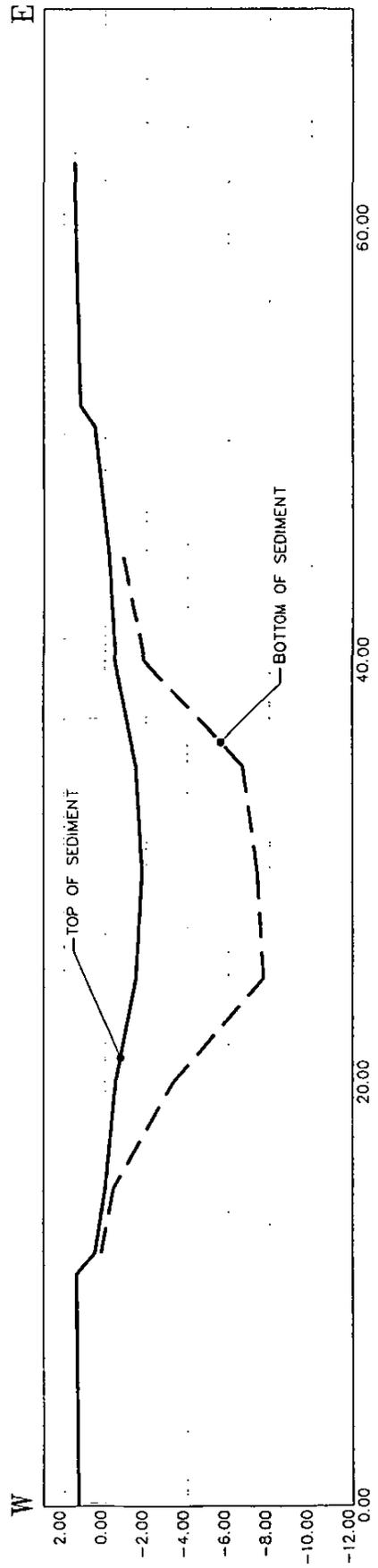
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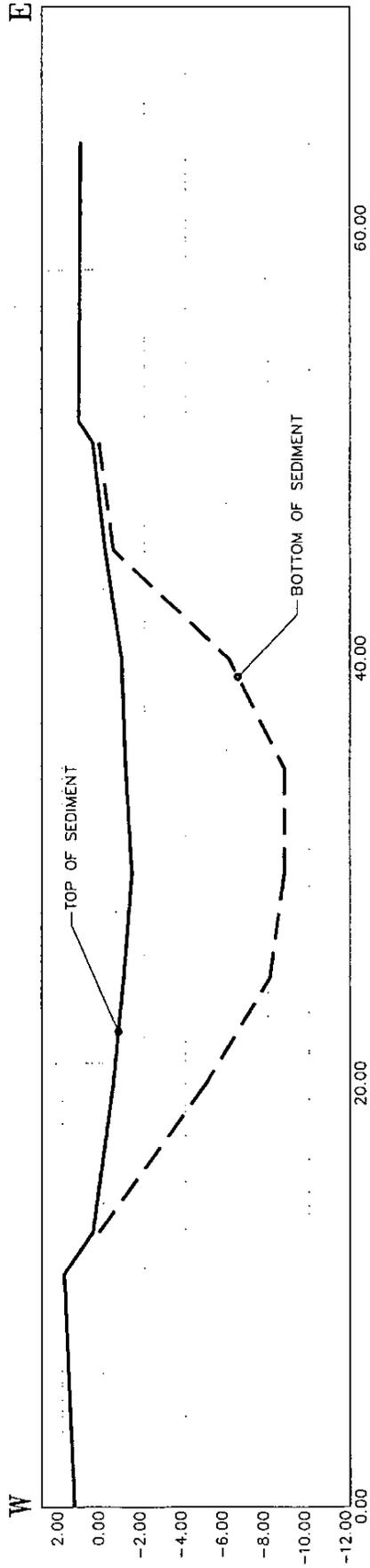
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**SECTION 44+00**

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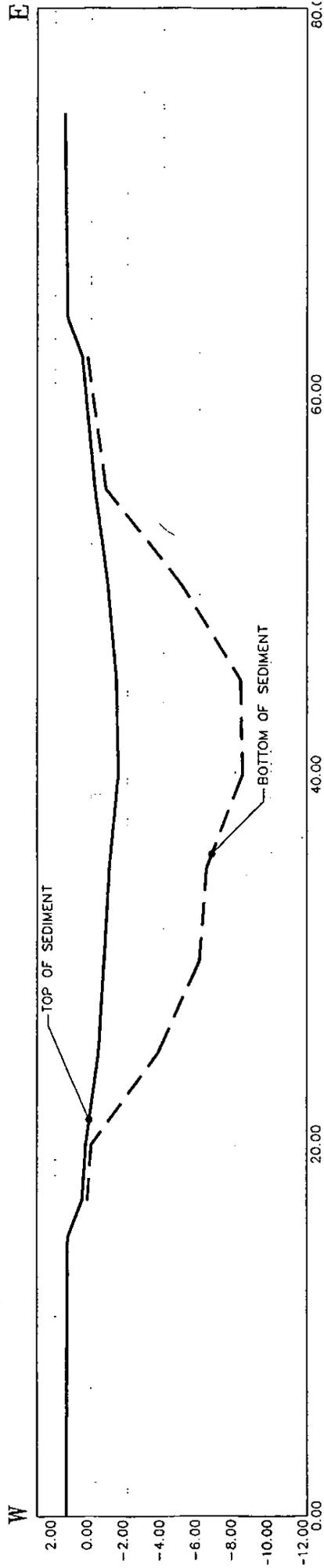


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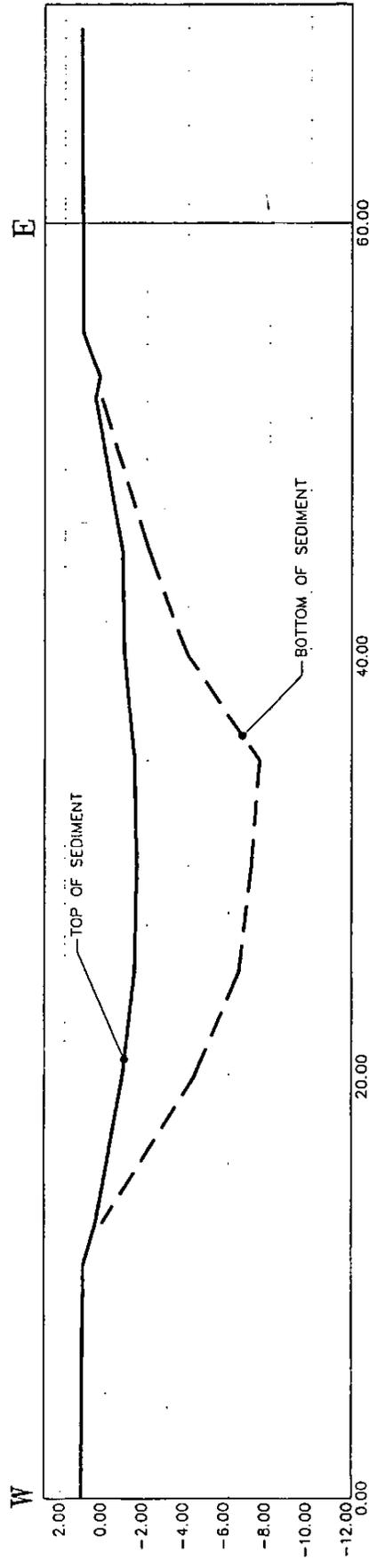
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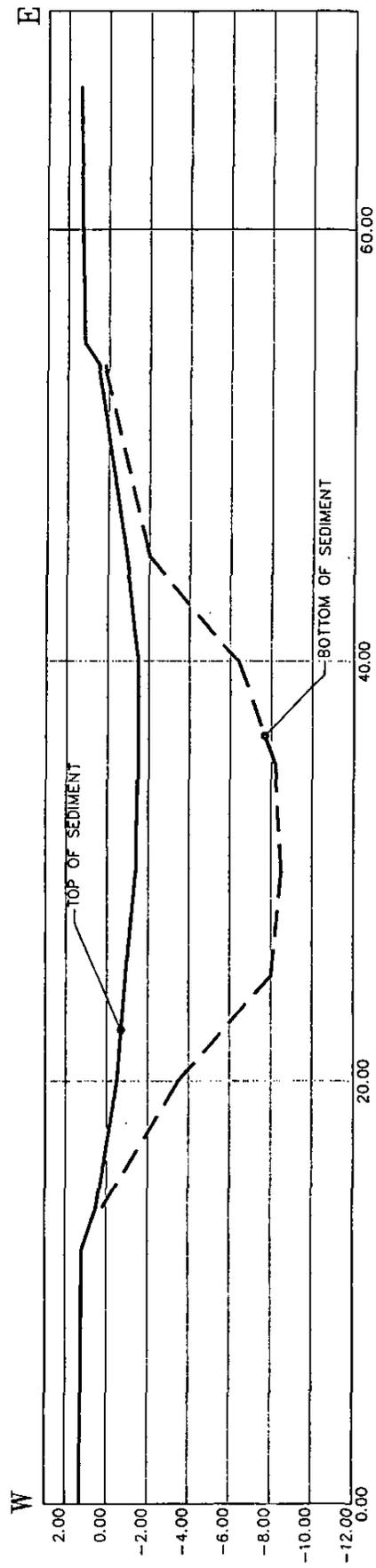
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SCALE:



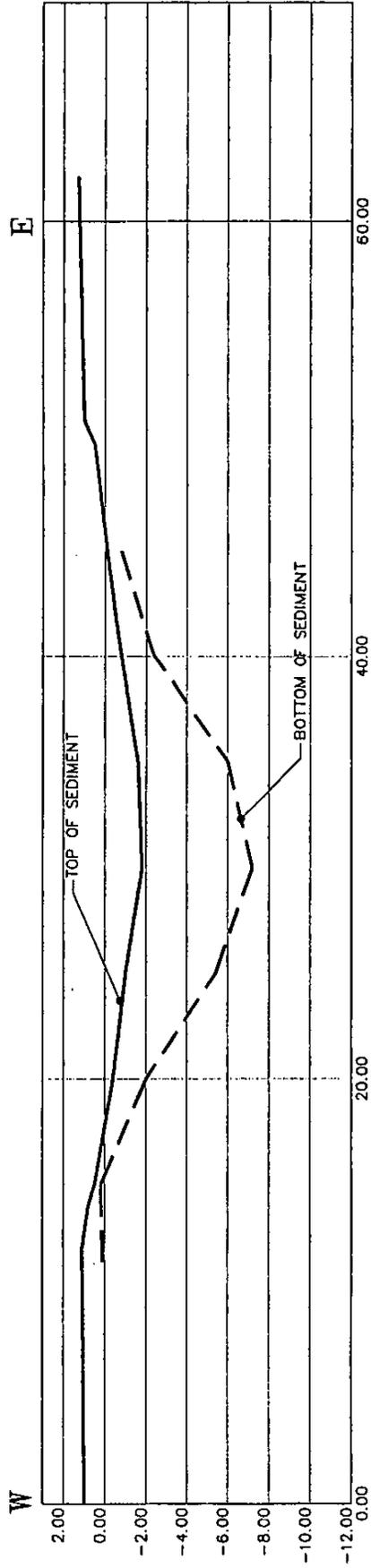
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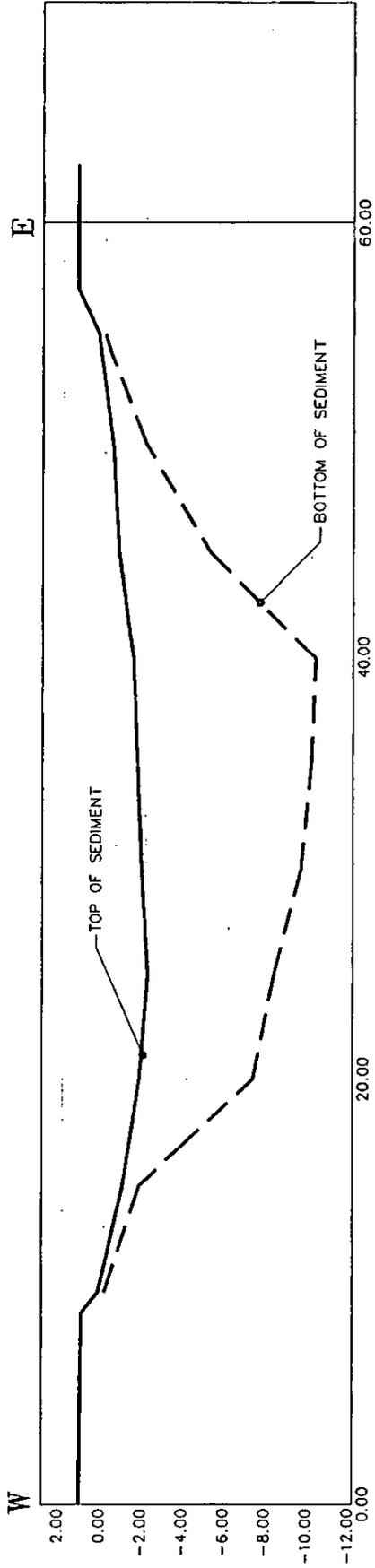
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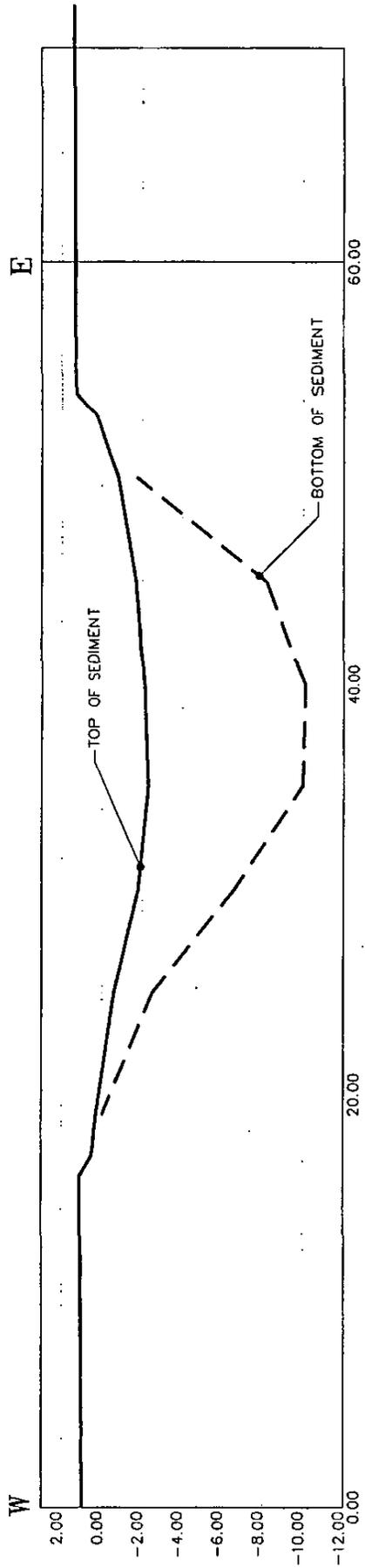
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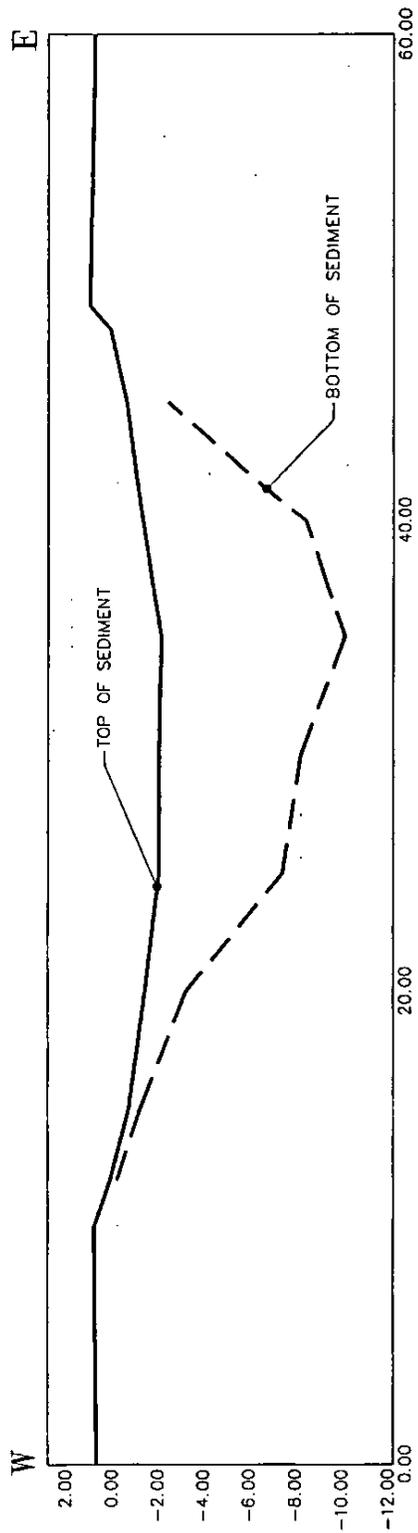
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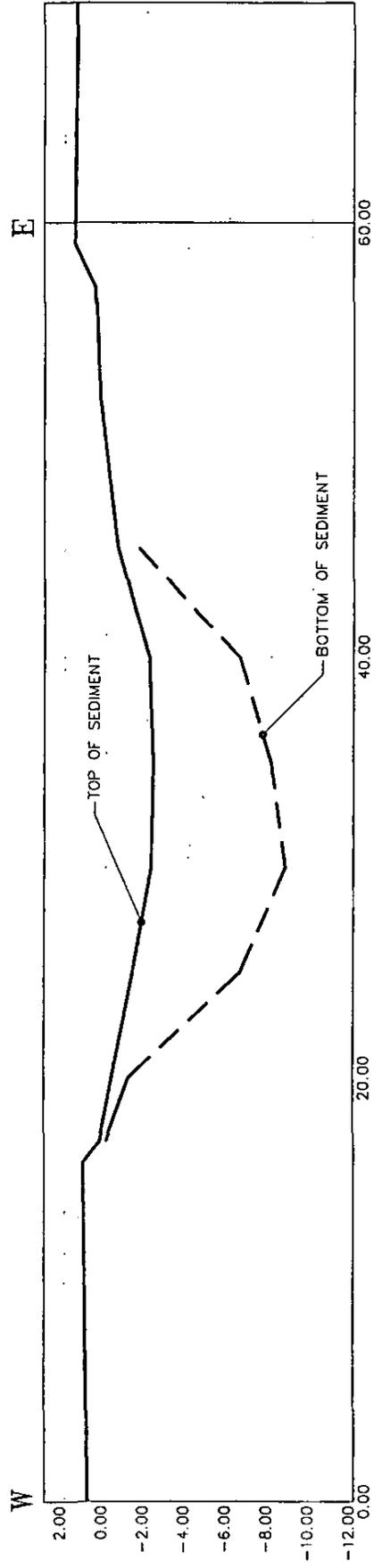
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SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



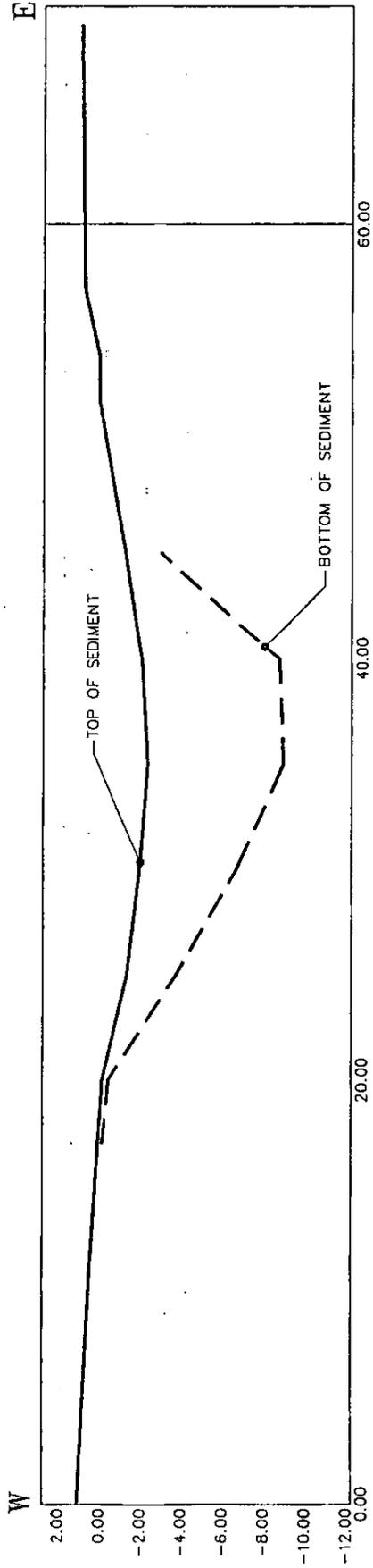
**SECTION 52+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



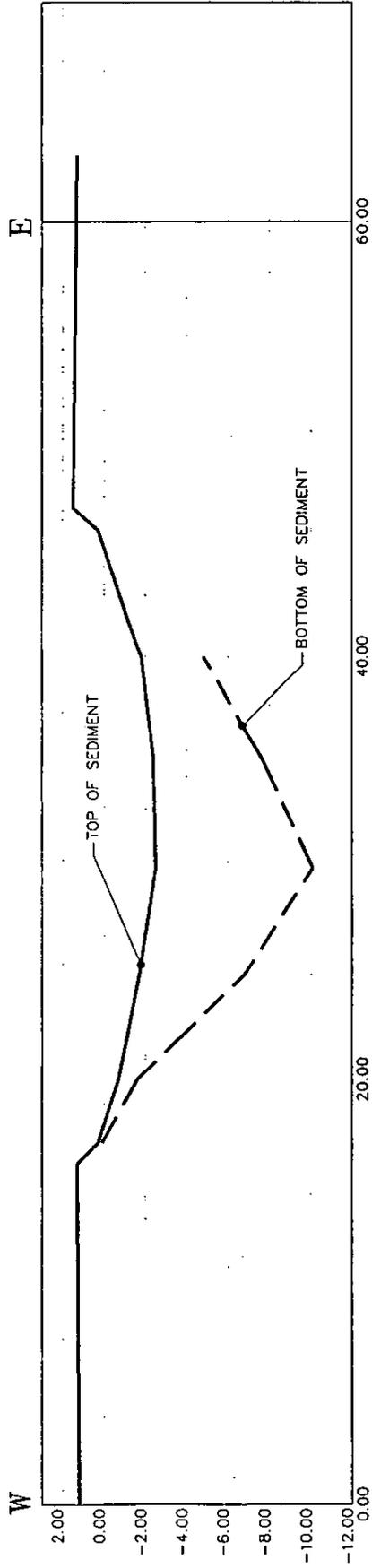
**SECTION 53+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



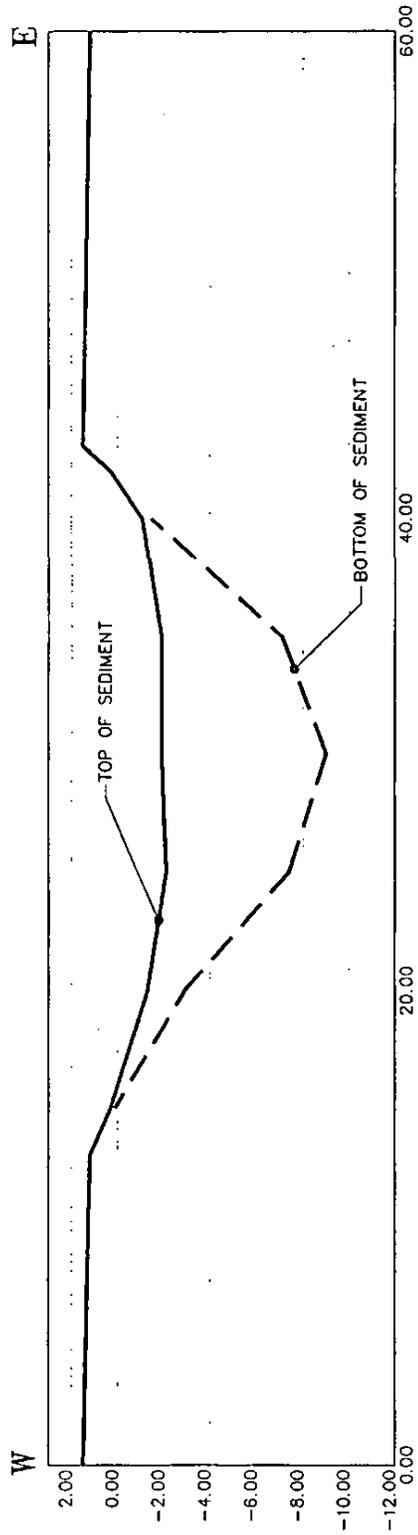
**SECTION 54+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



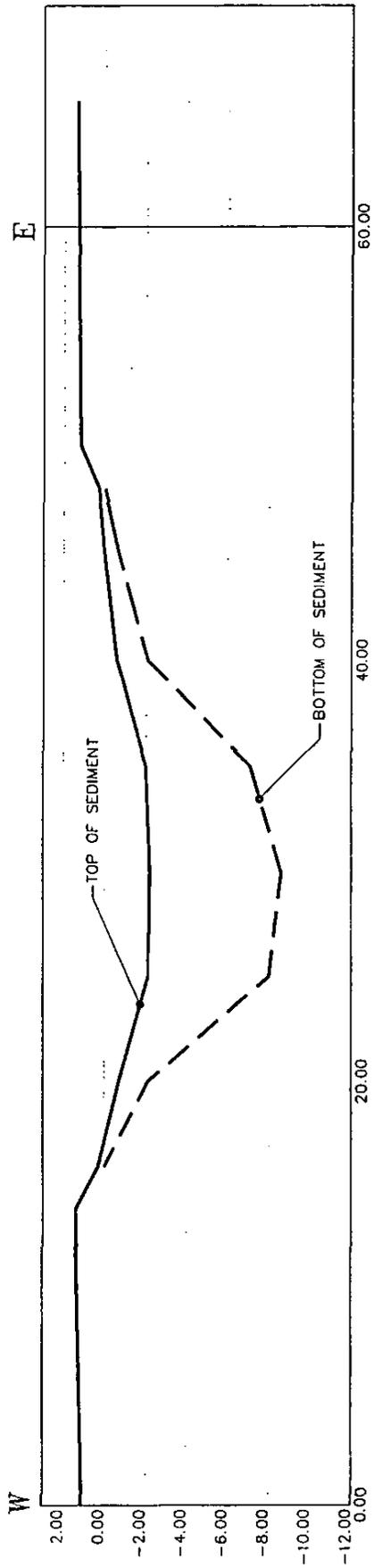
**SECTION 55+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



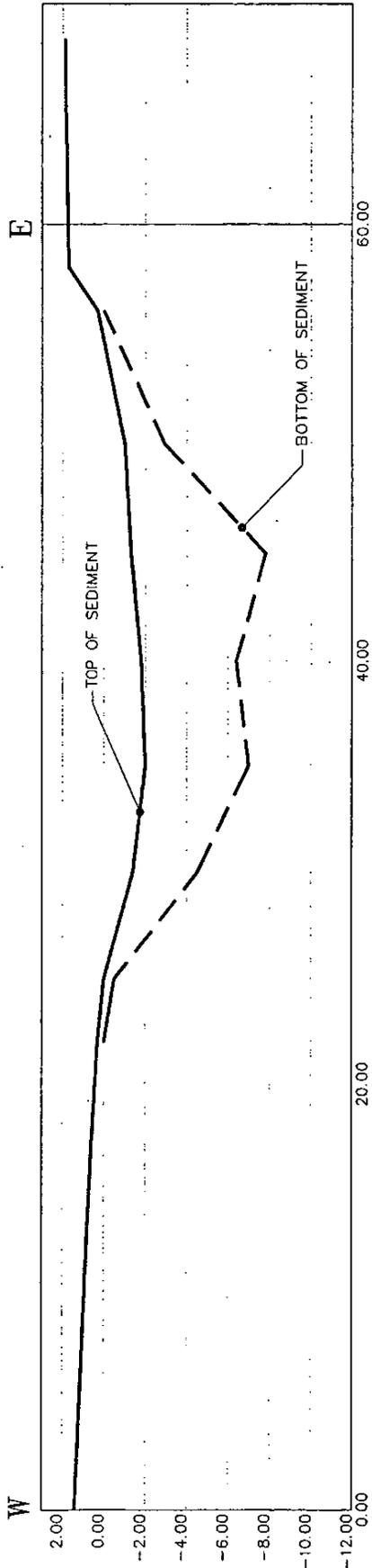
**SECTION 56+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



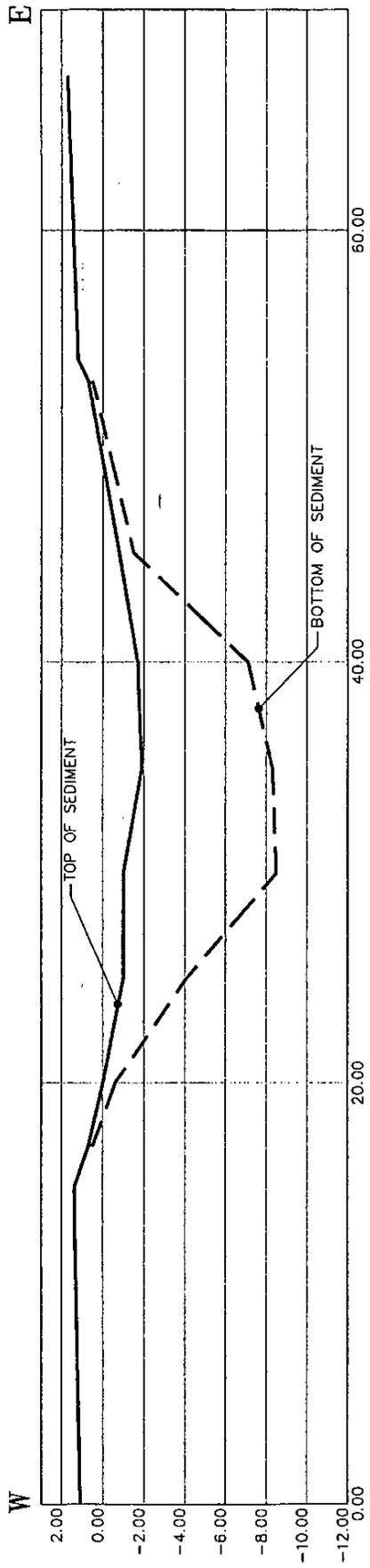
**SECTION 57+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



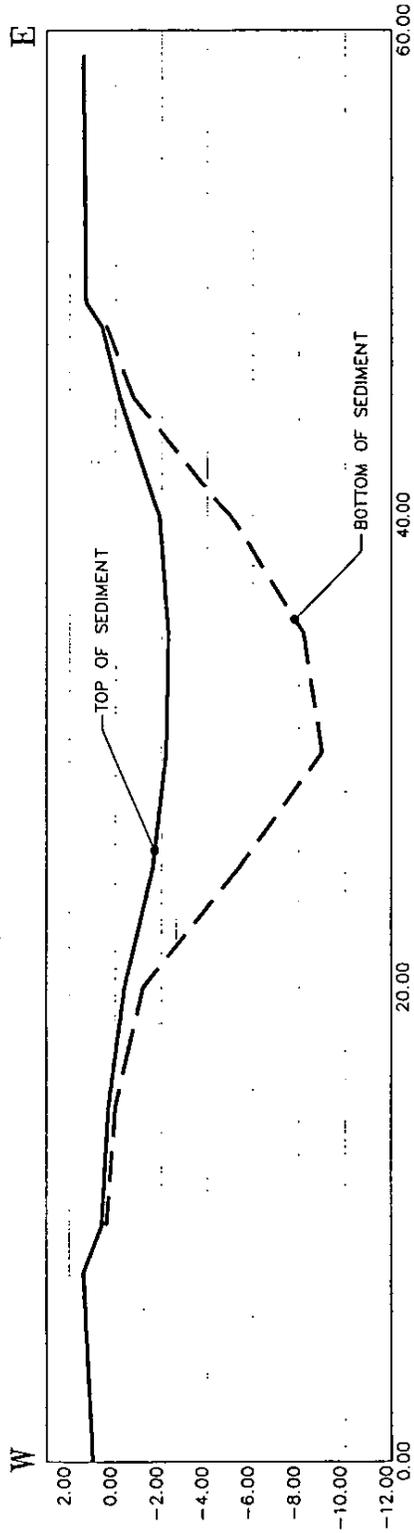
**SECTION 58+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



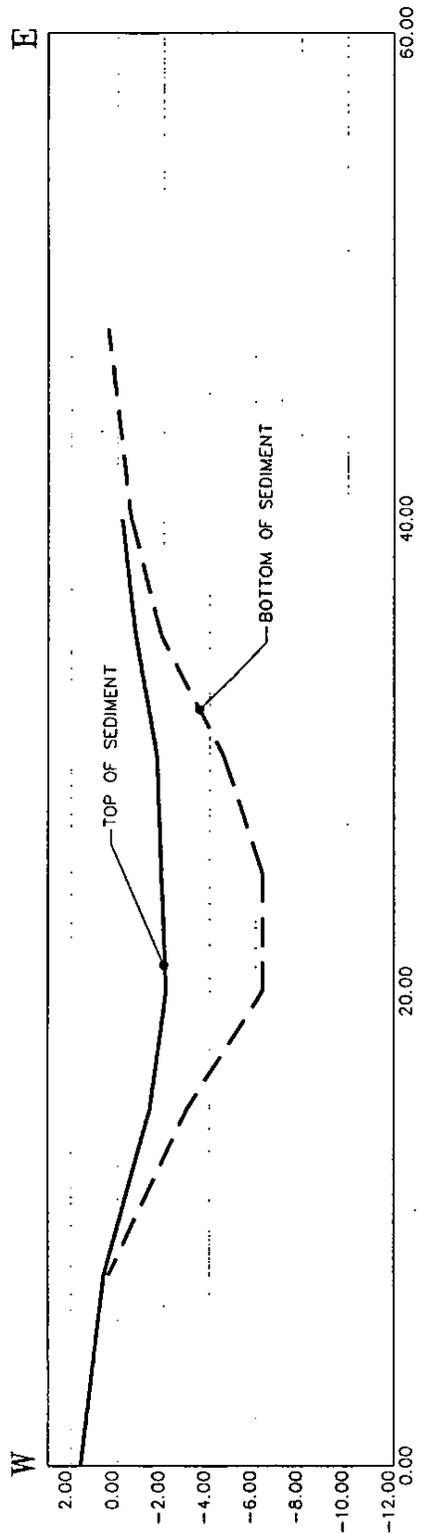
**SECTION 59+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



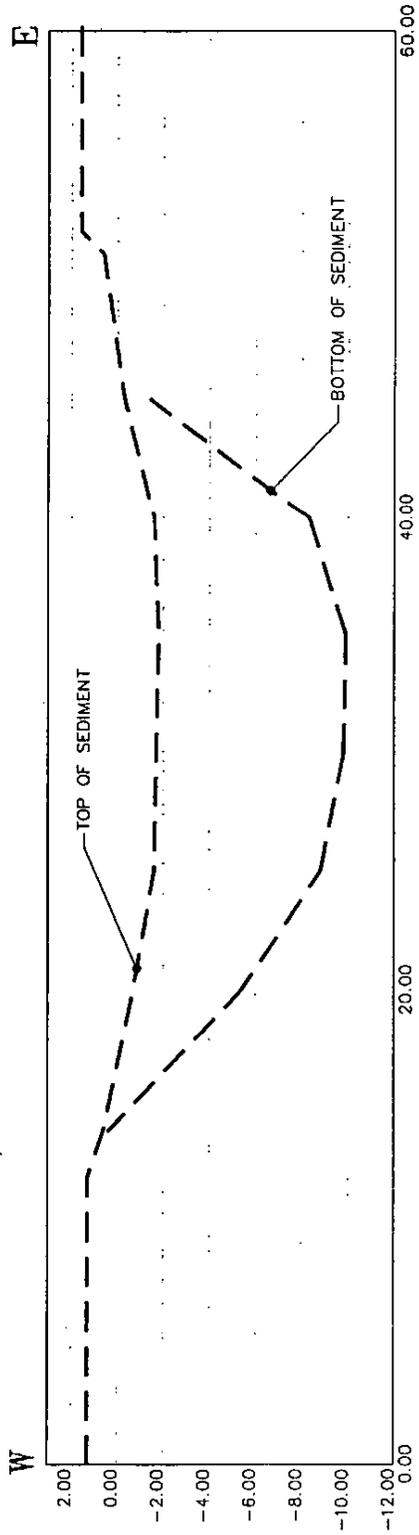
SECTION 60+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



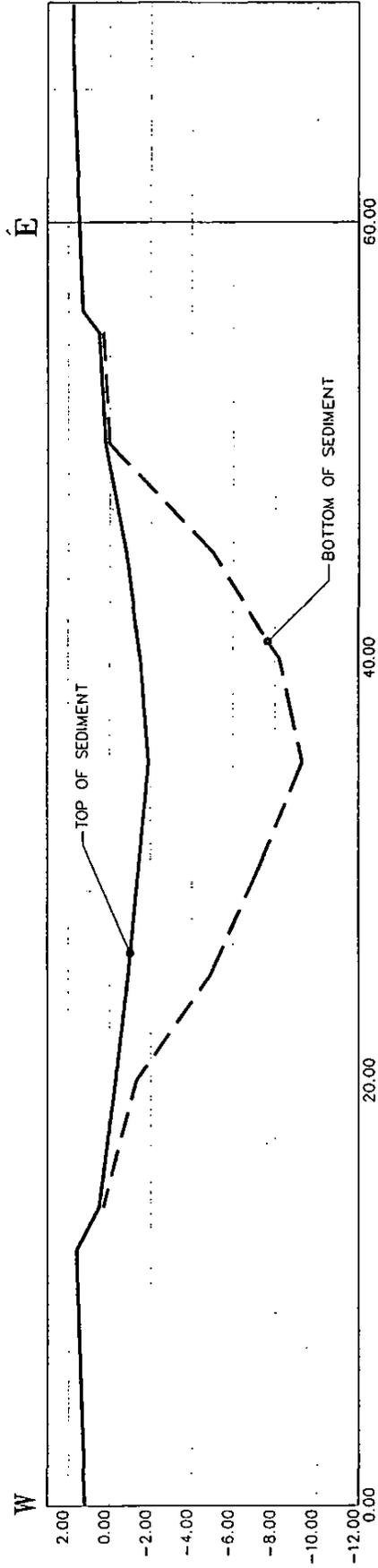
**SECTION 61+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



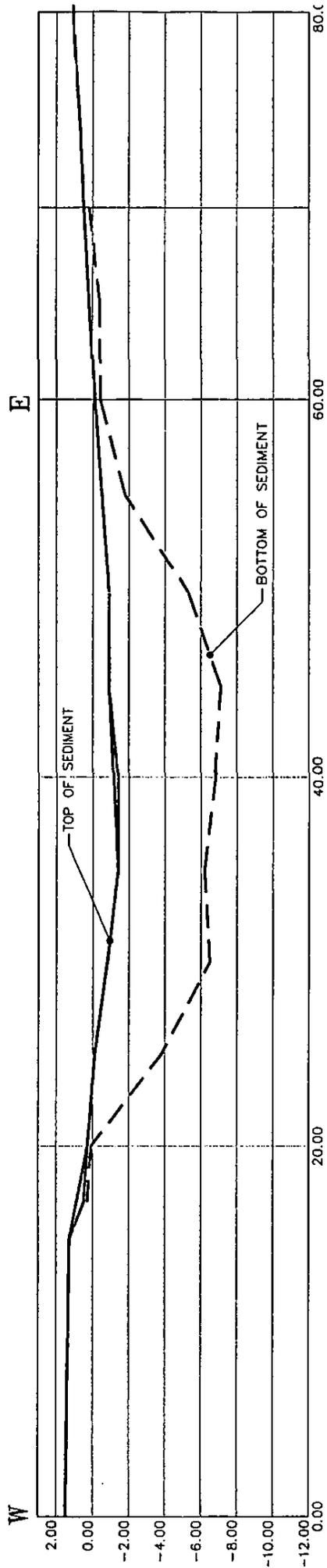
**SECTION 62+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



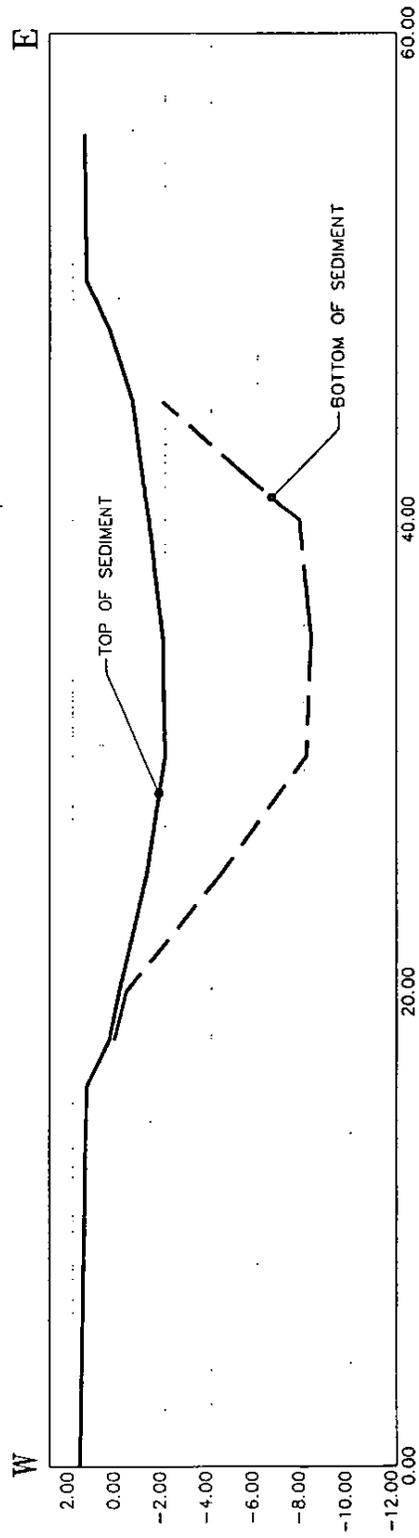
**SECTION 63+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



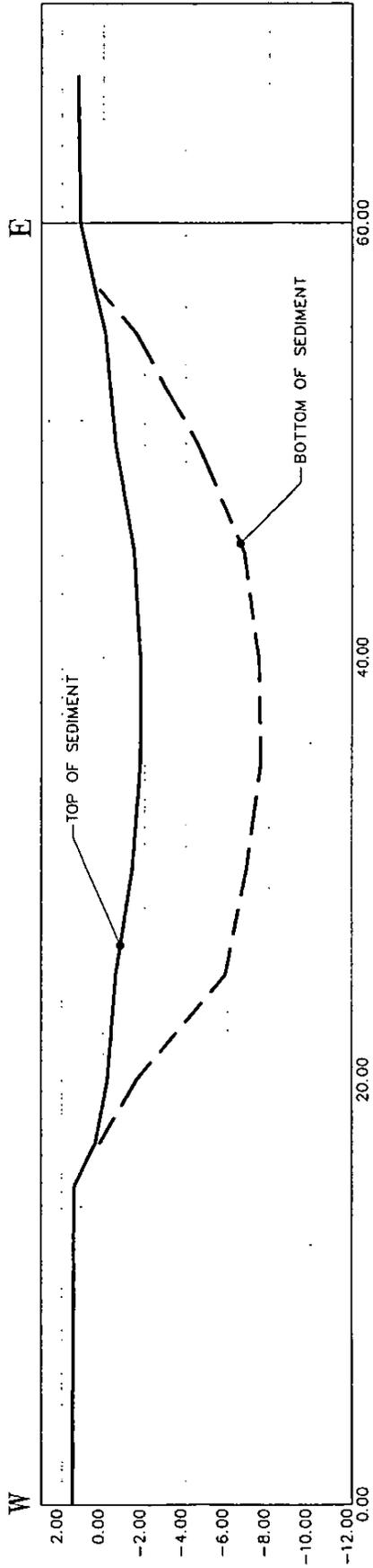
**SECTION 64+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



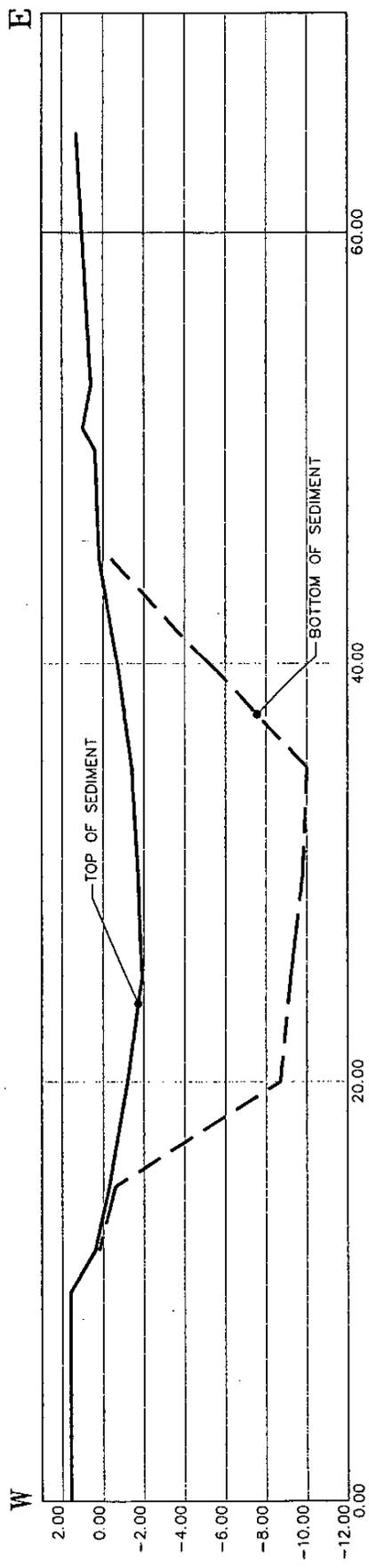
**SECTION 65+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



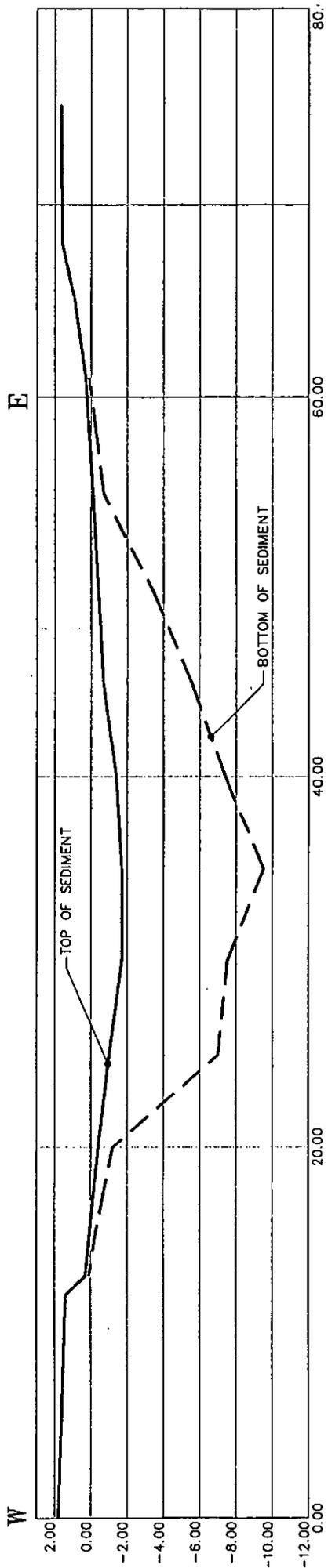
**SECTION 66+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



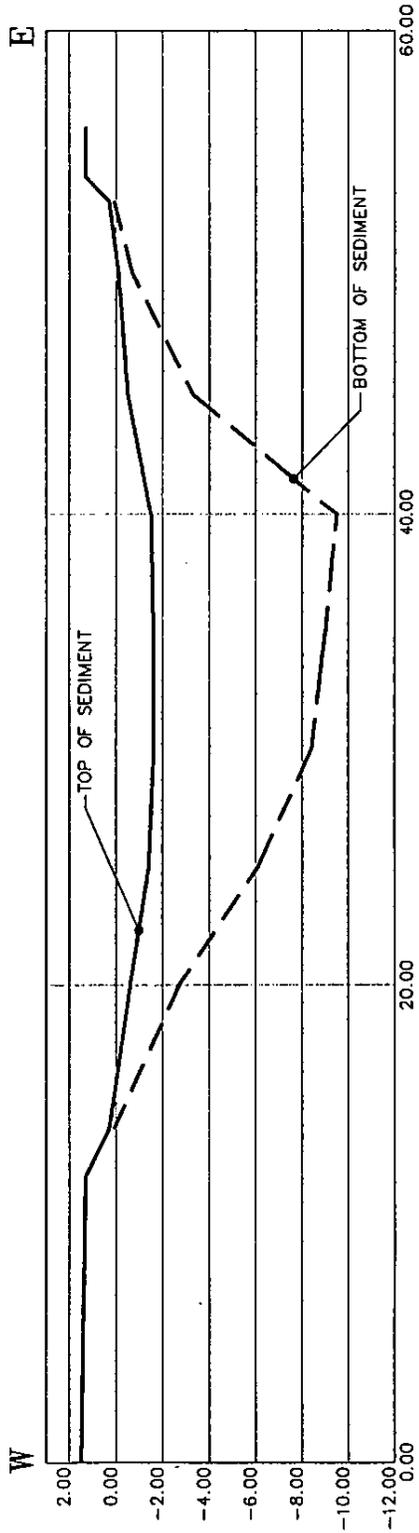
**SECTION 67+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



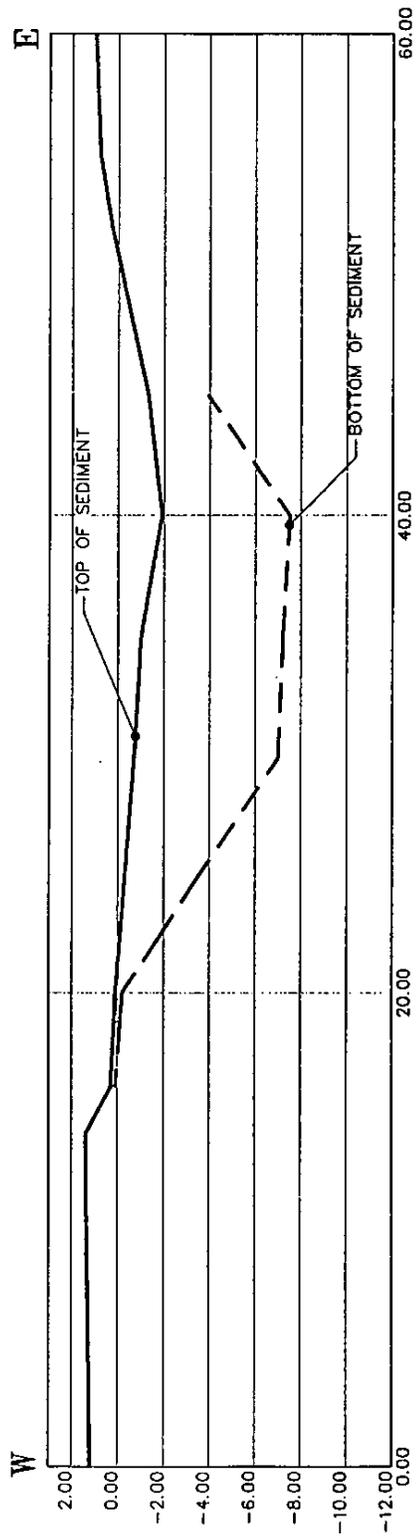
**SECTION 68+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



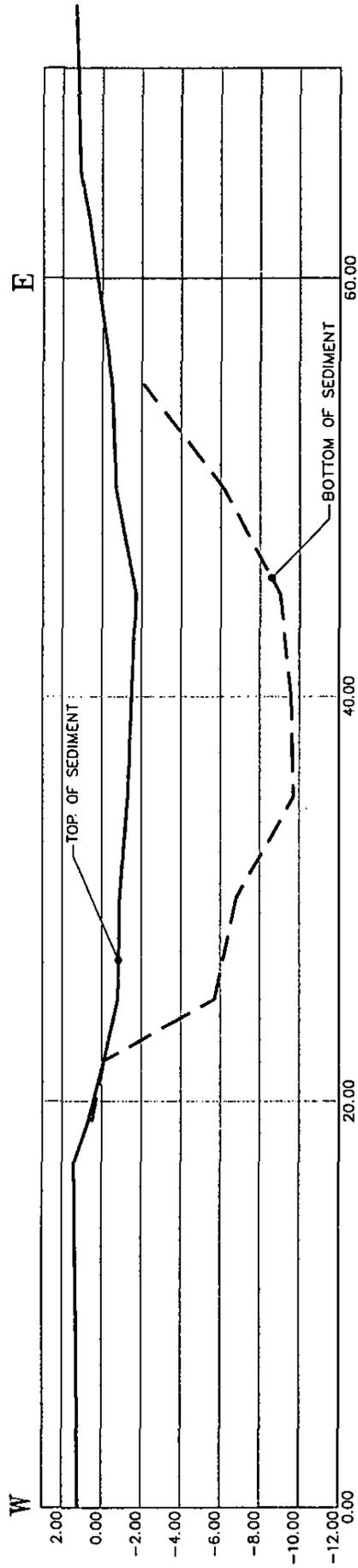
**SECTION 69+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



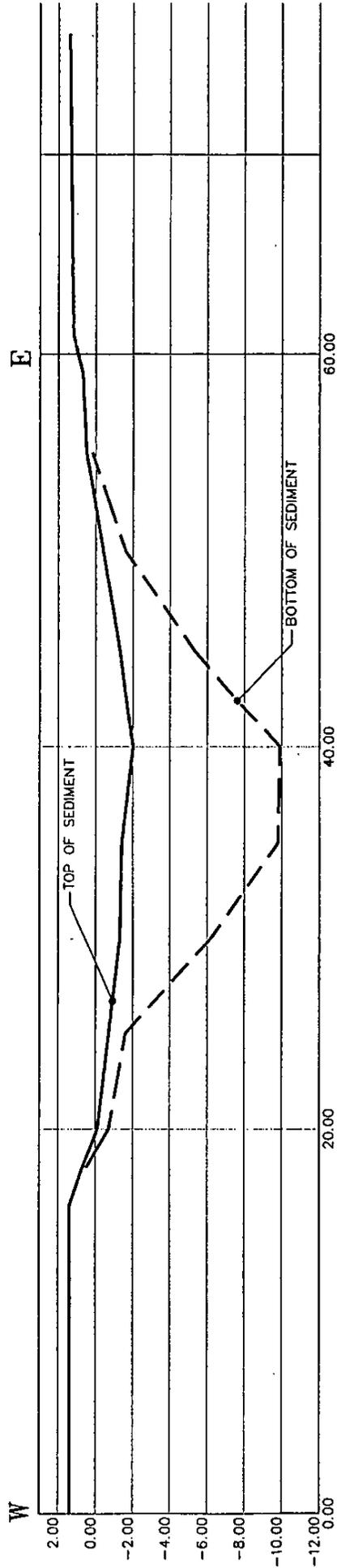
**SECTION 70+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



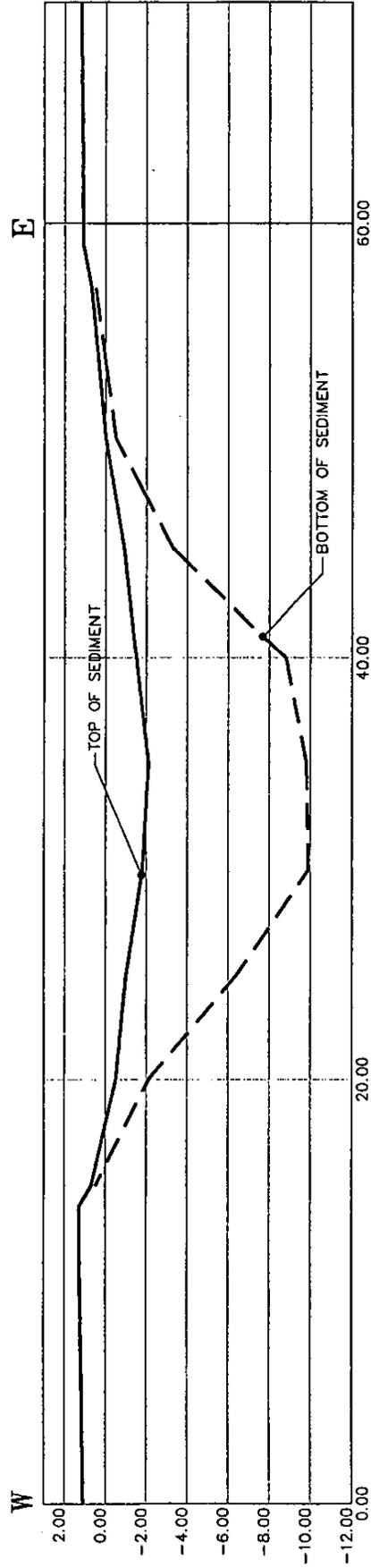
**SECTION 71+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



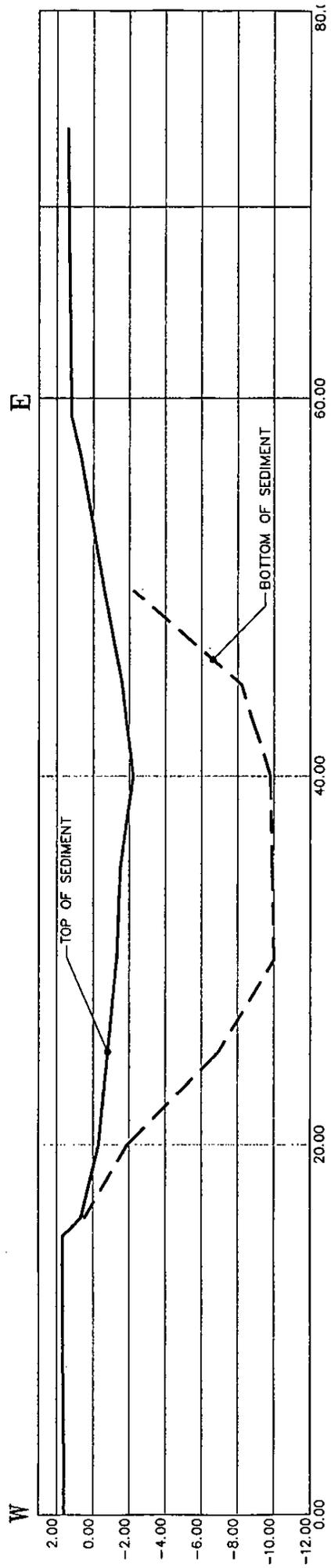
**SECTION 72+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



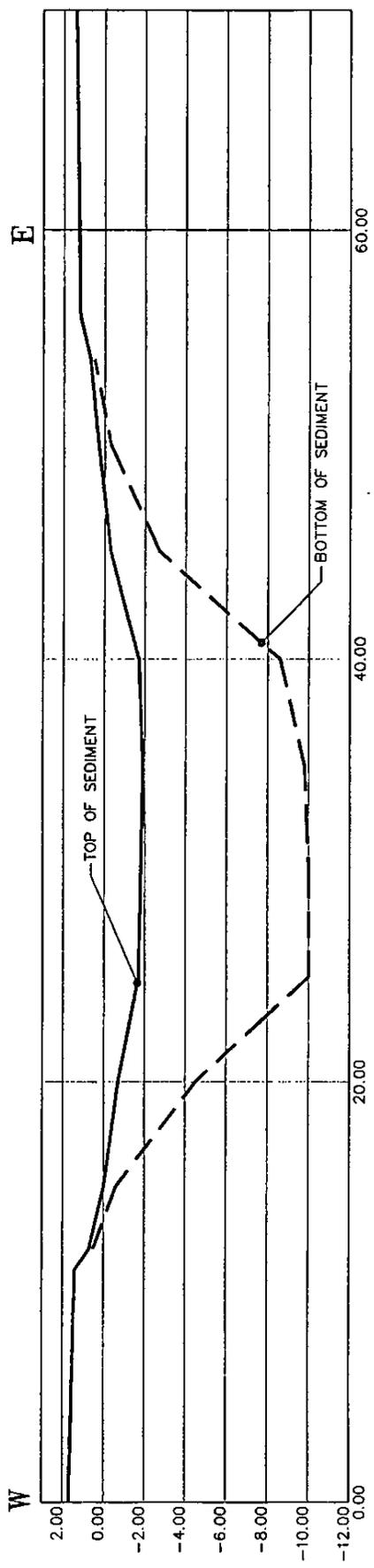
**SECTION 73+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



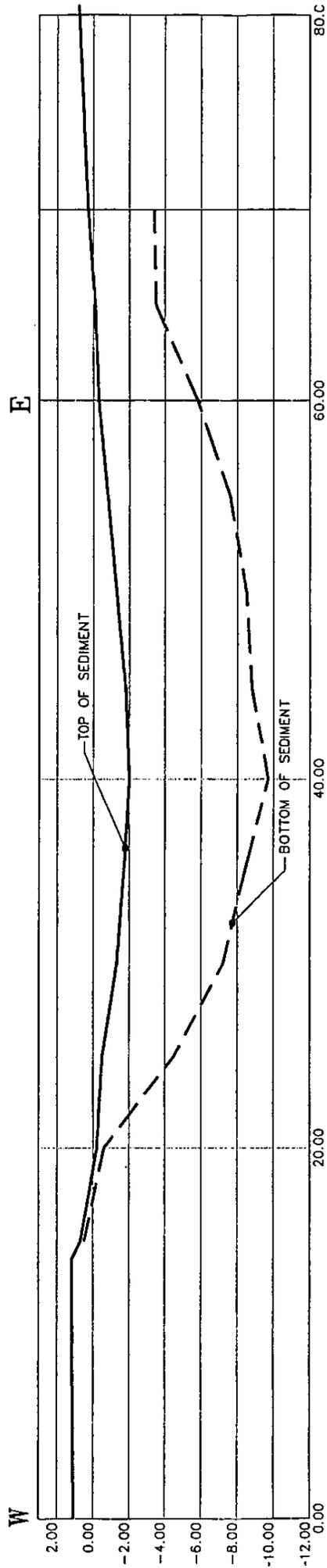
**SECTION 74+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



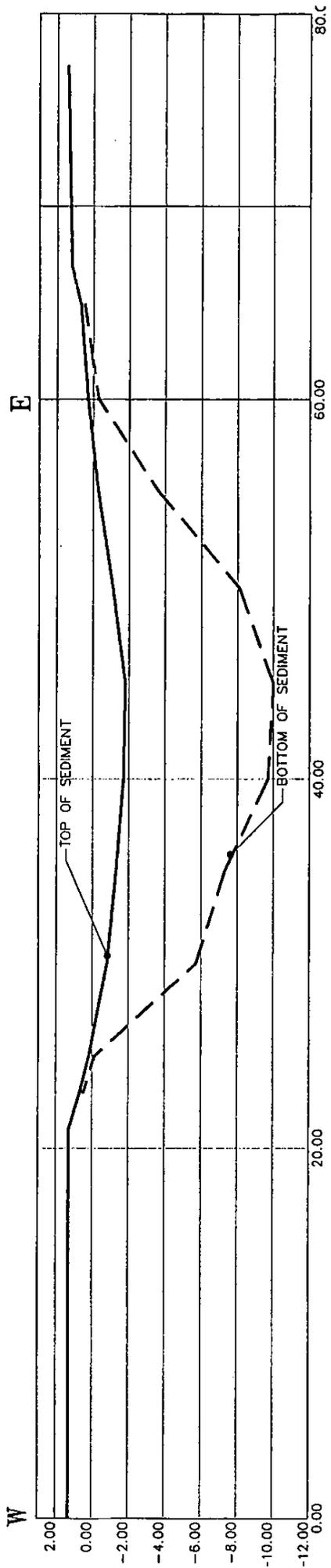
**SECTION 75+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



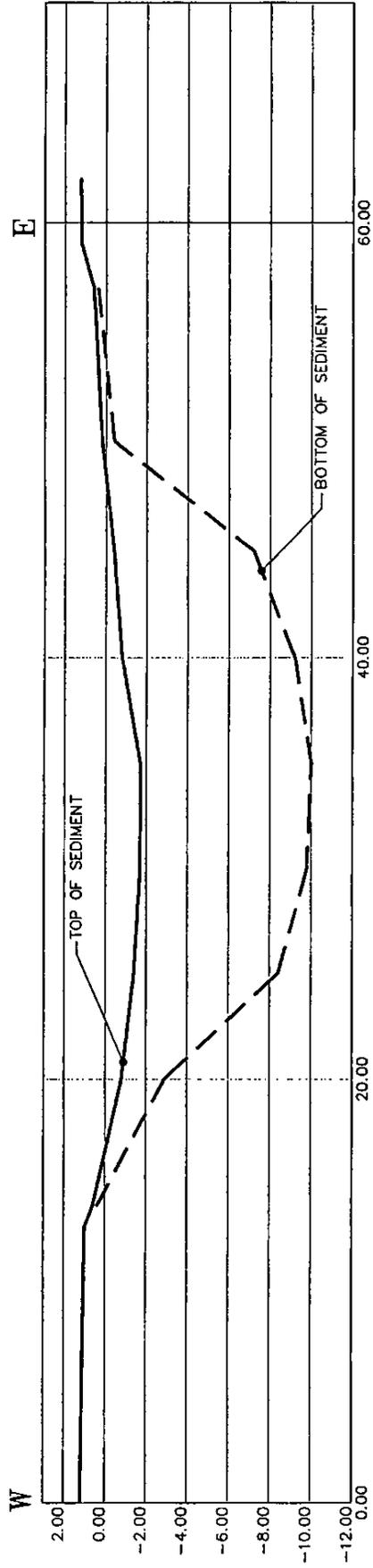
**SECTION 76+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



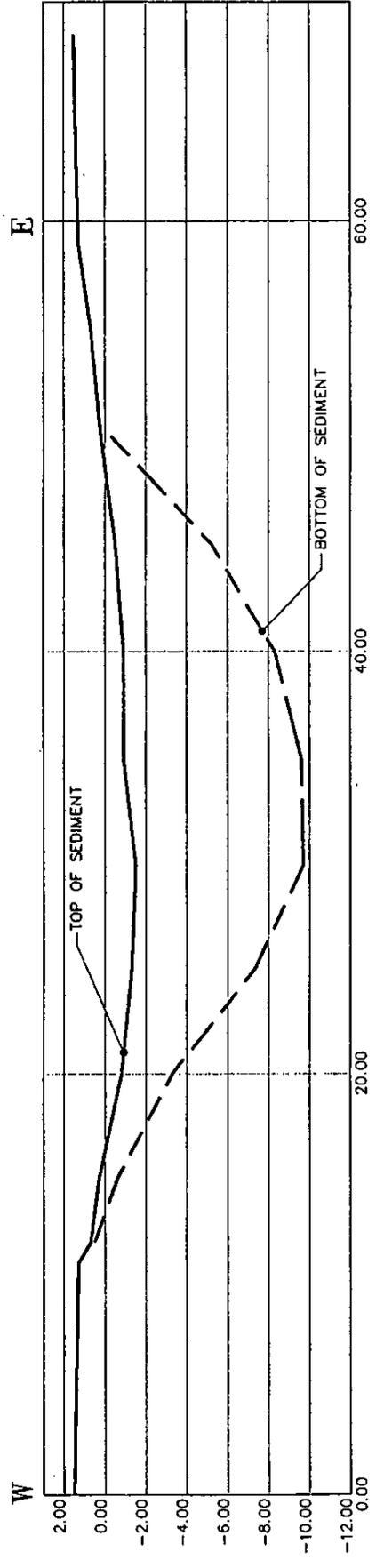
**SECTION 77+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



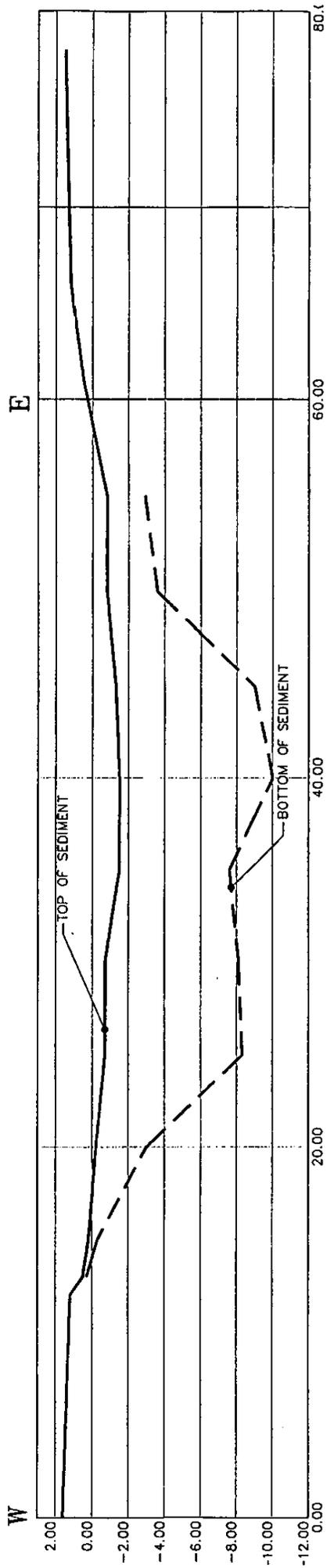
**SECTION 78+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



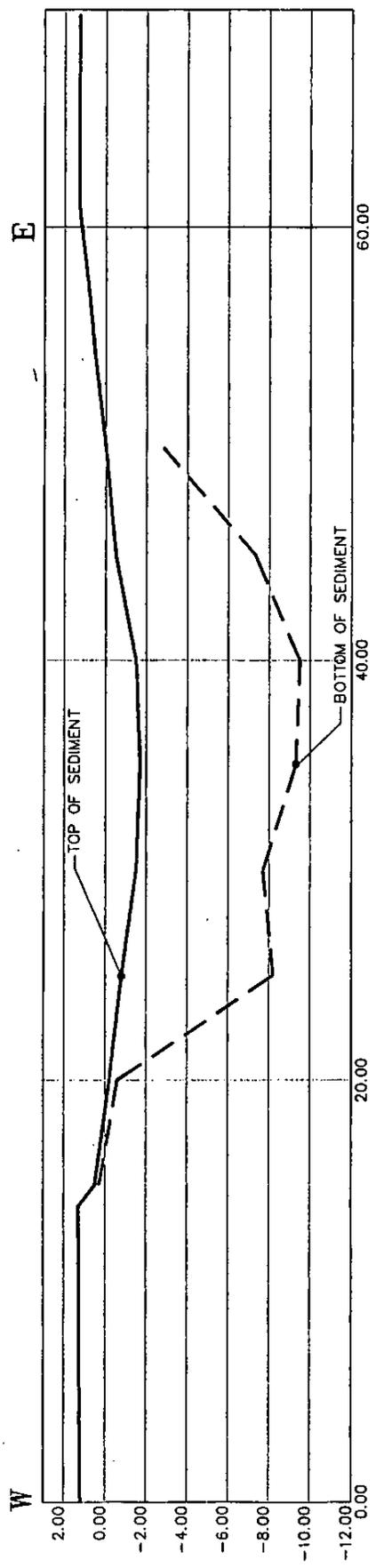
**SECTION 79+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



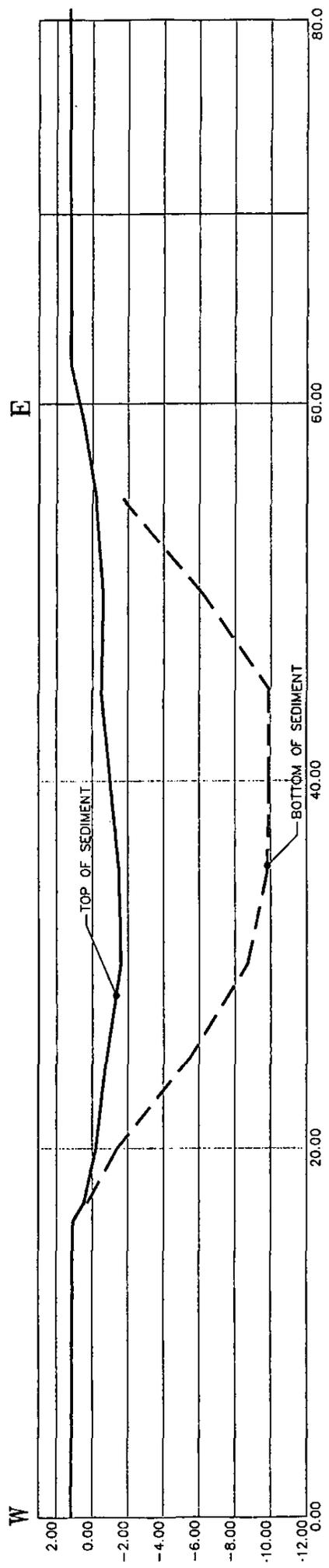
**SECTION 80+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



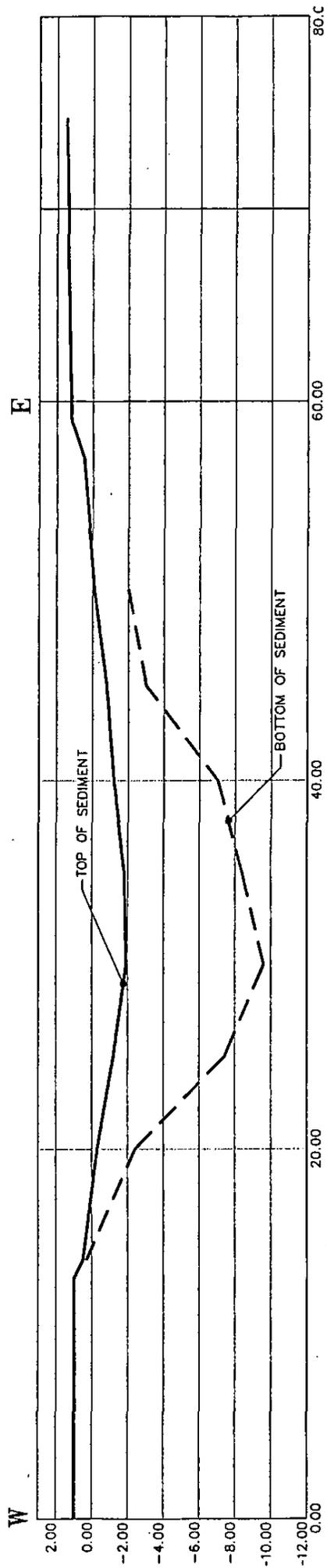
**SECTION 81+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



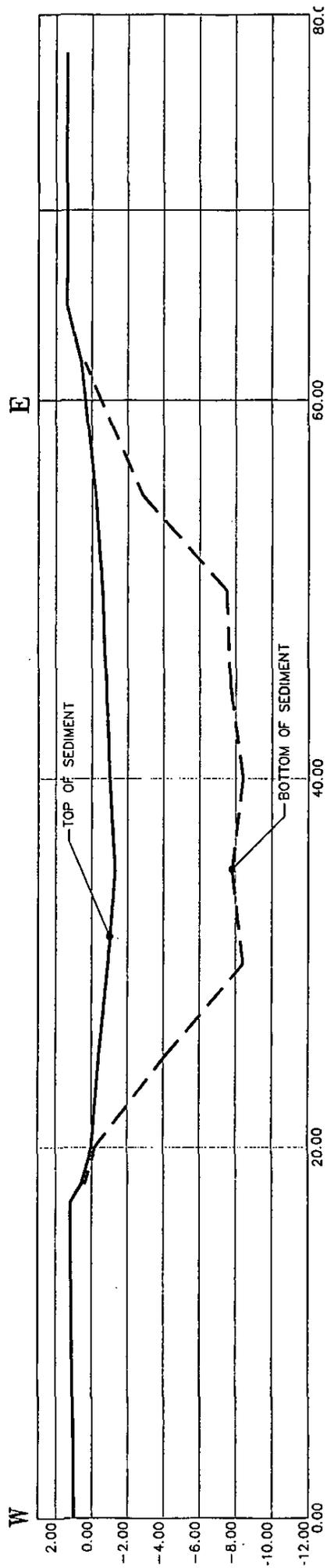
**SECTION 82+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



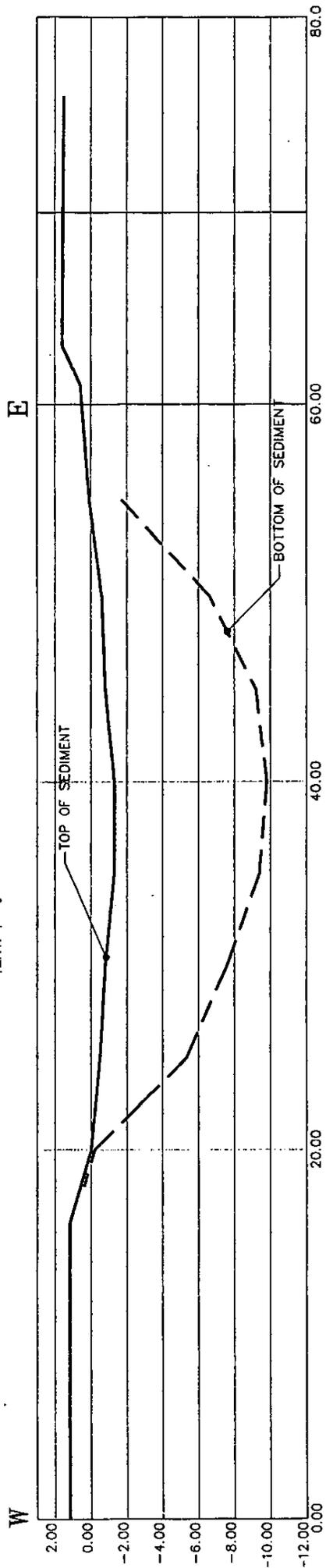
**SECTION 83+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



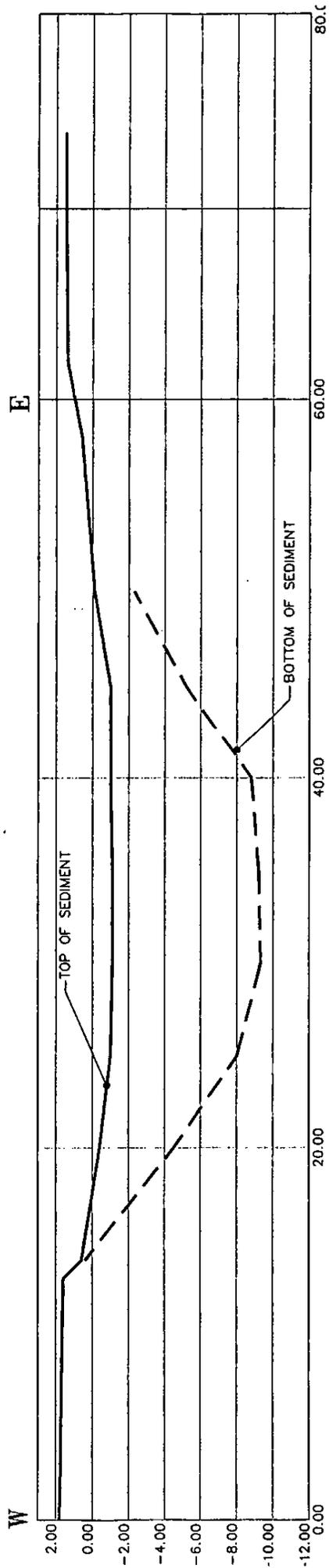
**SECTION 84+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



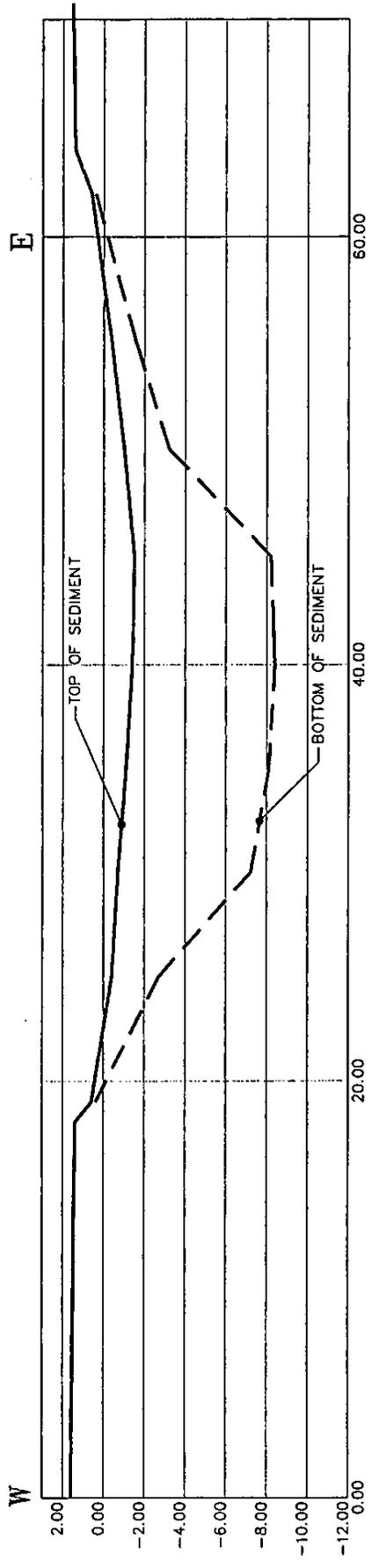
**SECTION 85+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



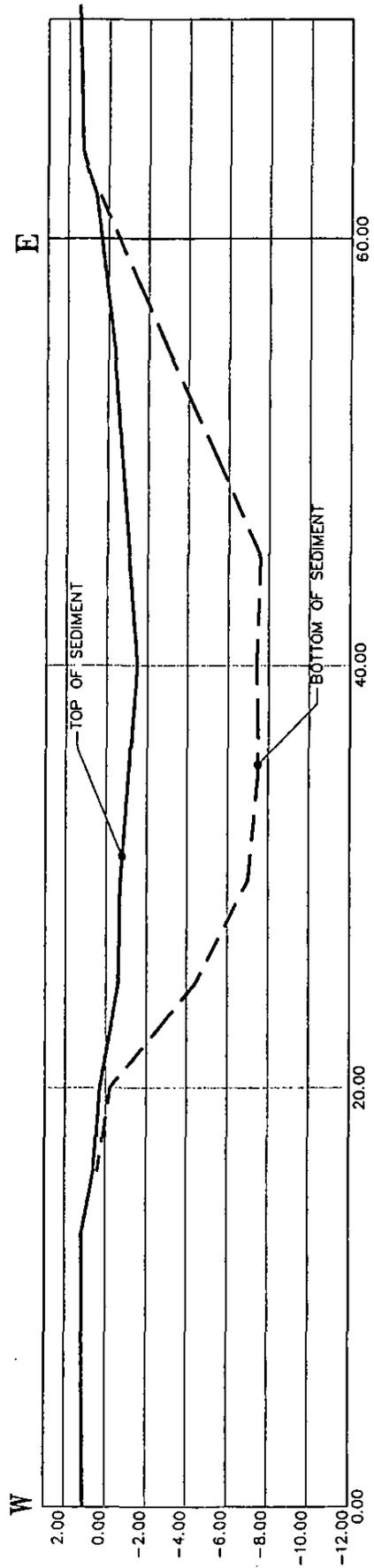
**SECTION 86+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



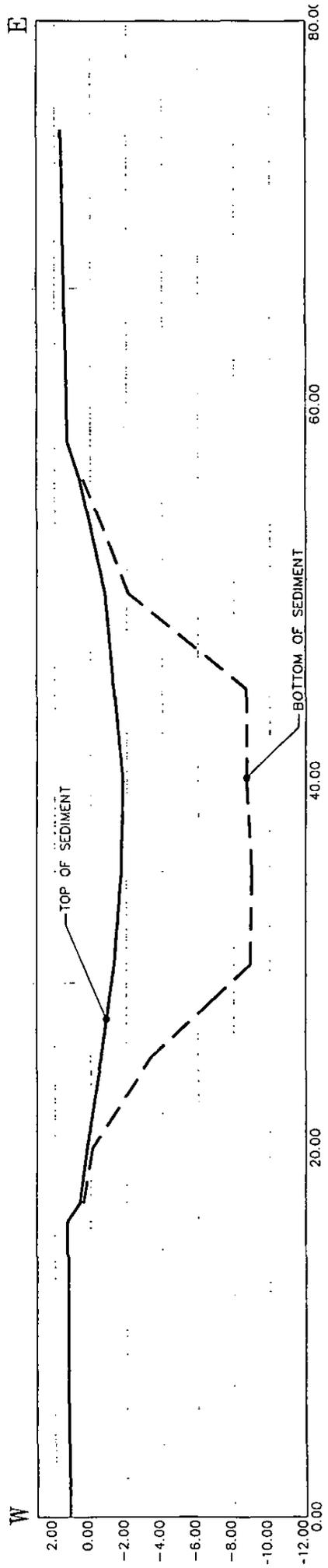
**SECTION 87+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



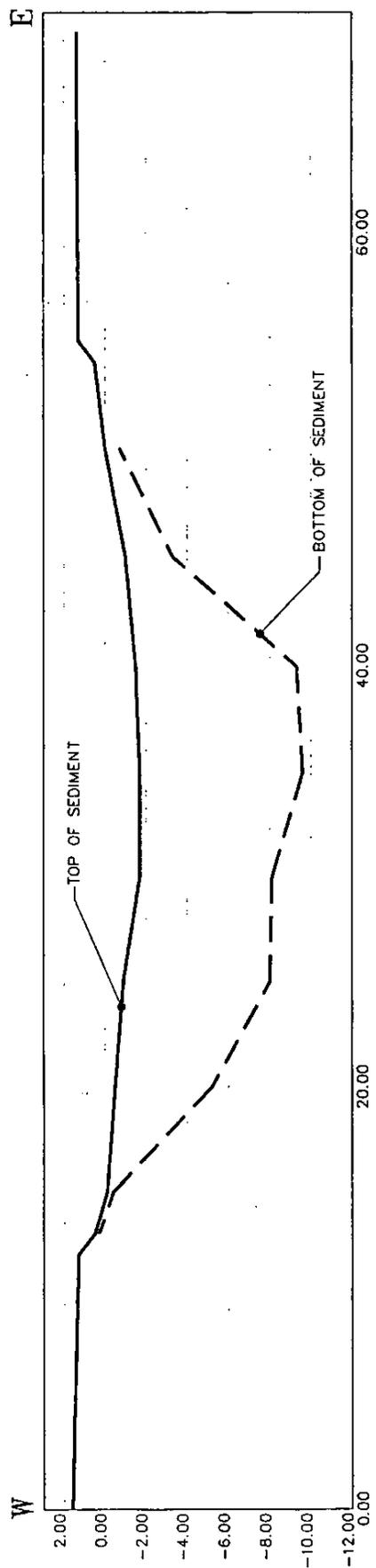
**SECTION 88+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



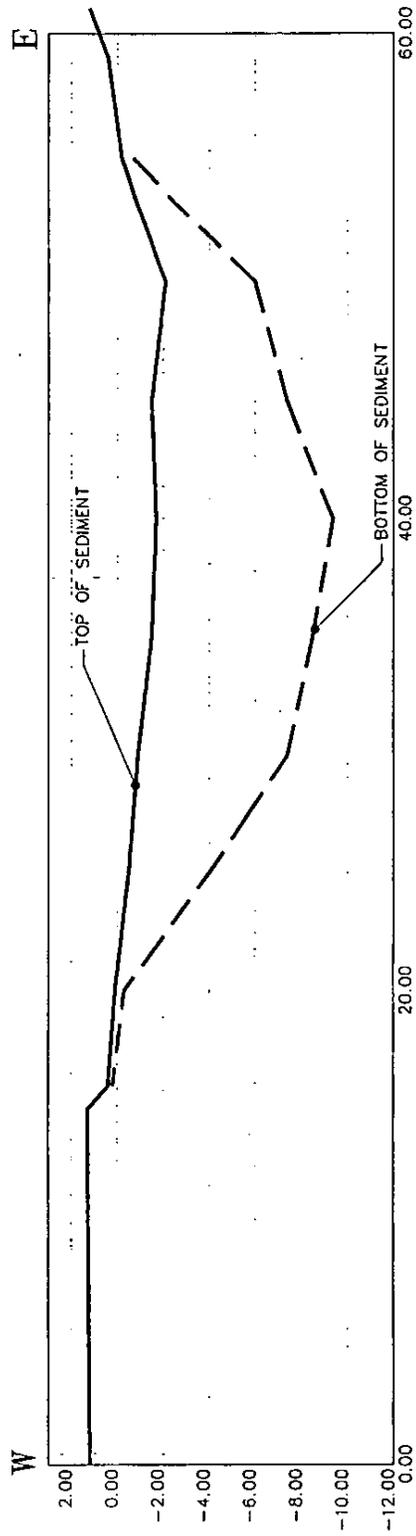
**SECTION 89+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



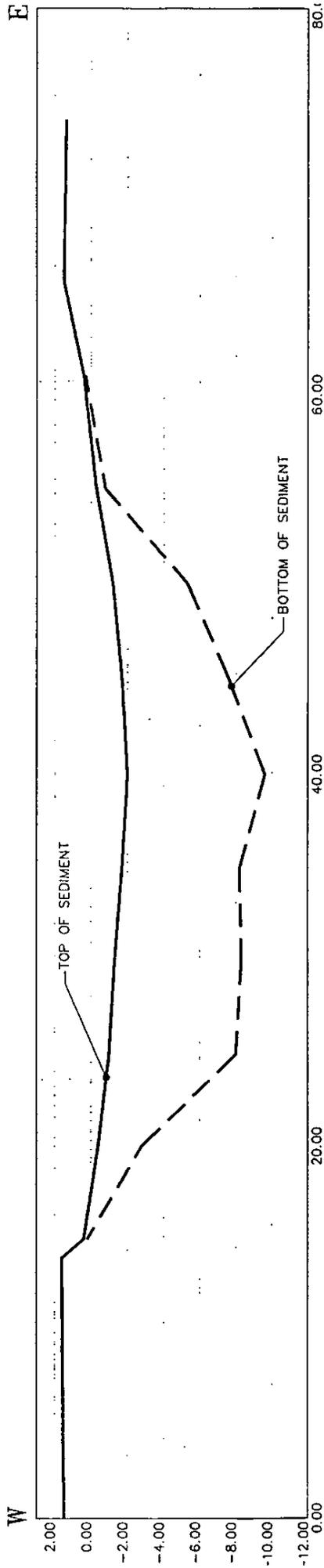
SECTION 90+00

SCALE: HORIZ. 1"=5'  
 VERT. 1"=5'



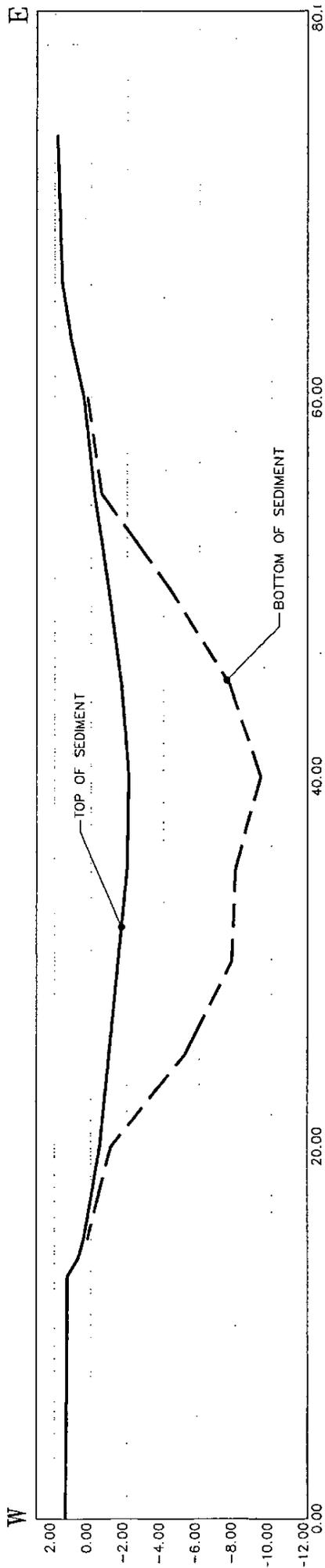
SECTION 91+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



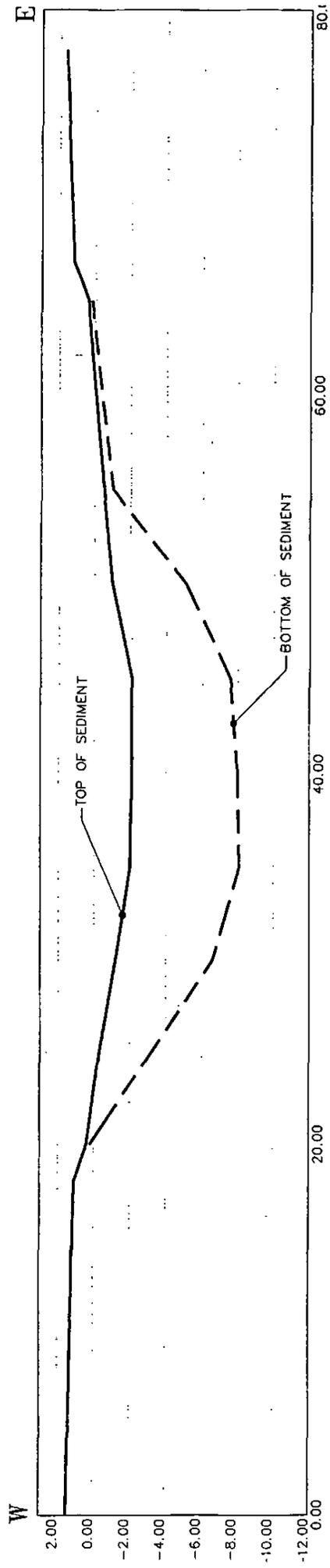
SECTION 92+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



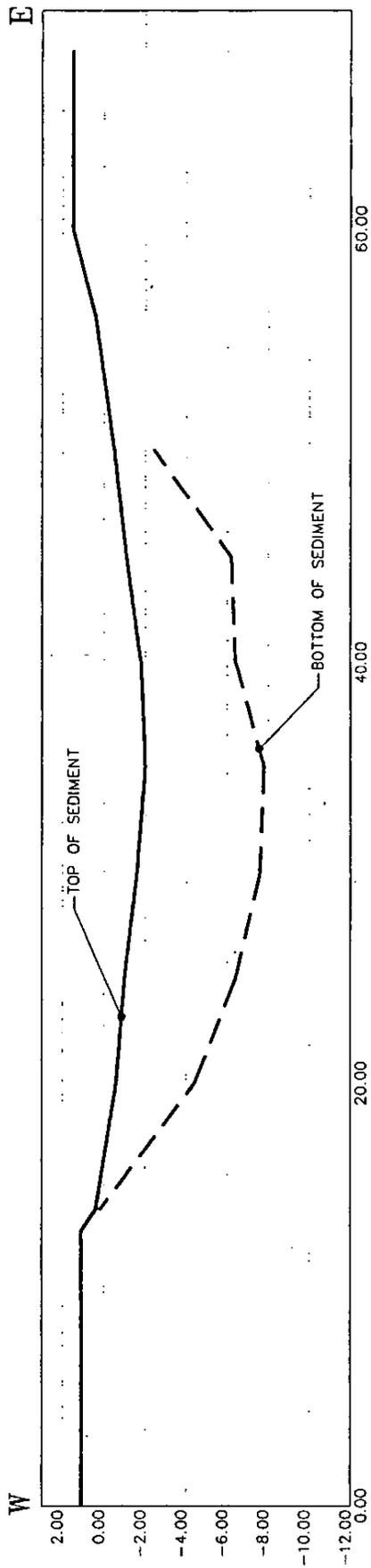
**SECTION 93+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



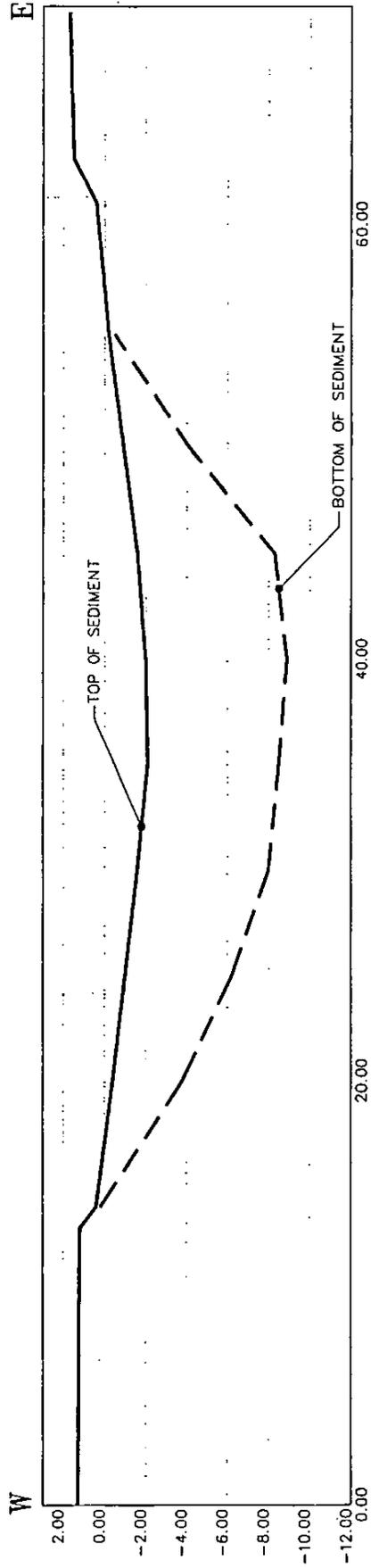
SECTION 94+00

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



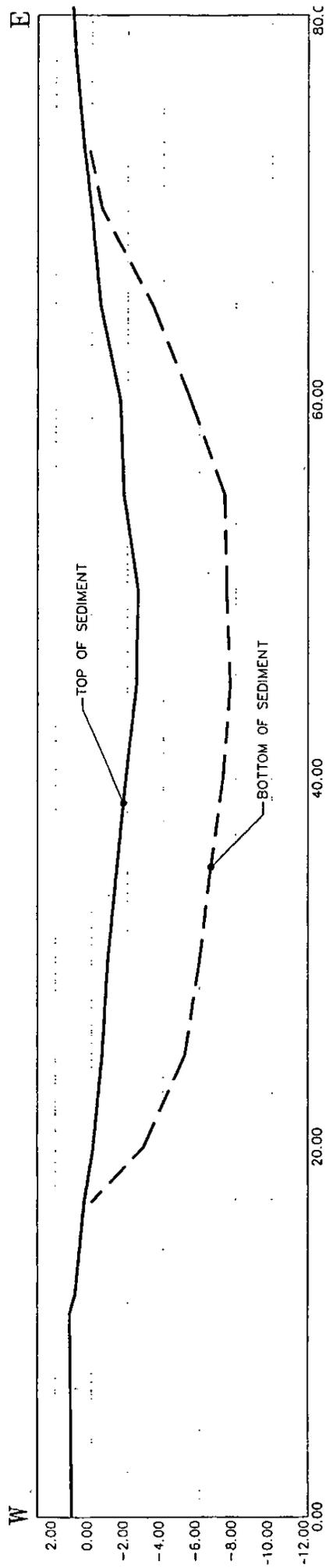
**SECTION 95+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



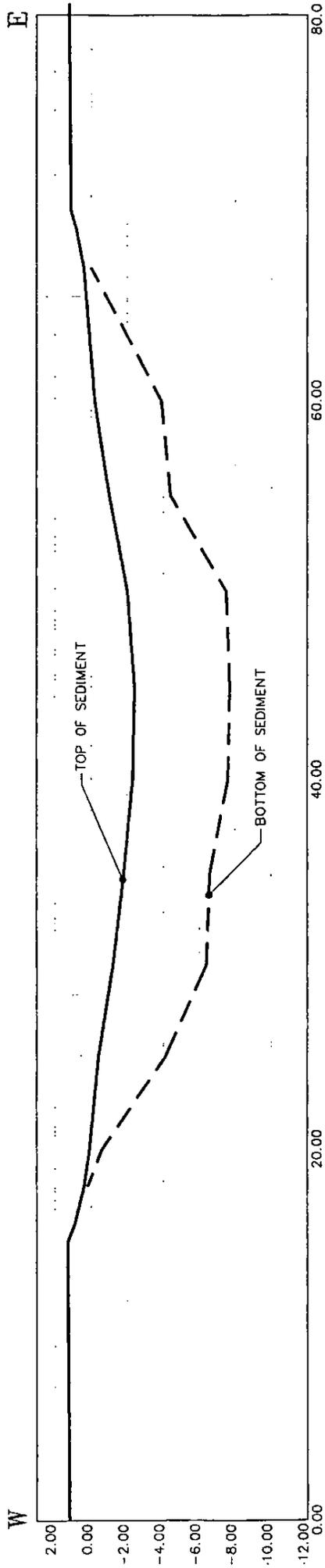
**SECTION 96+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



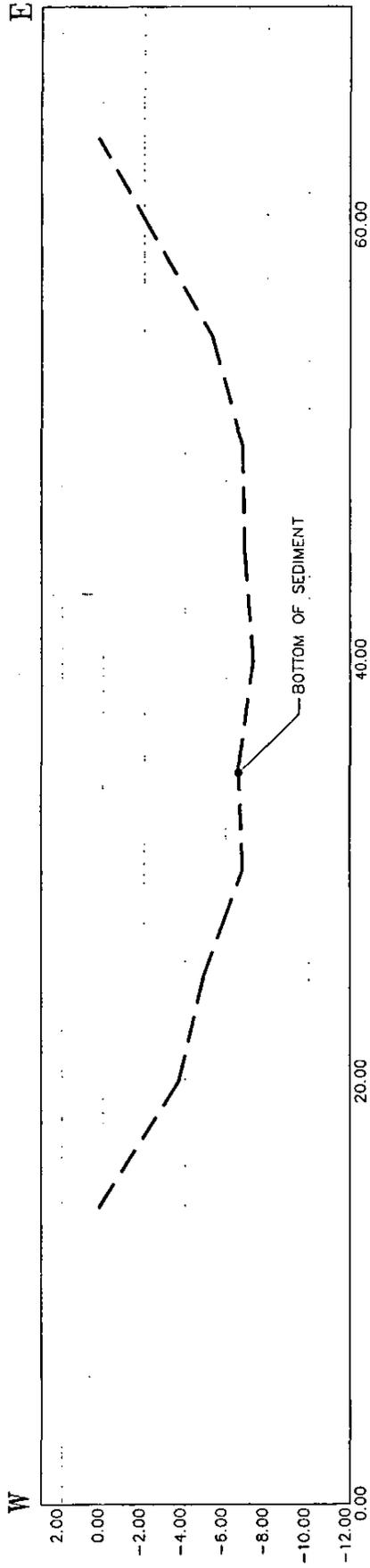
**SECTION 97+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



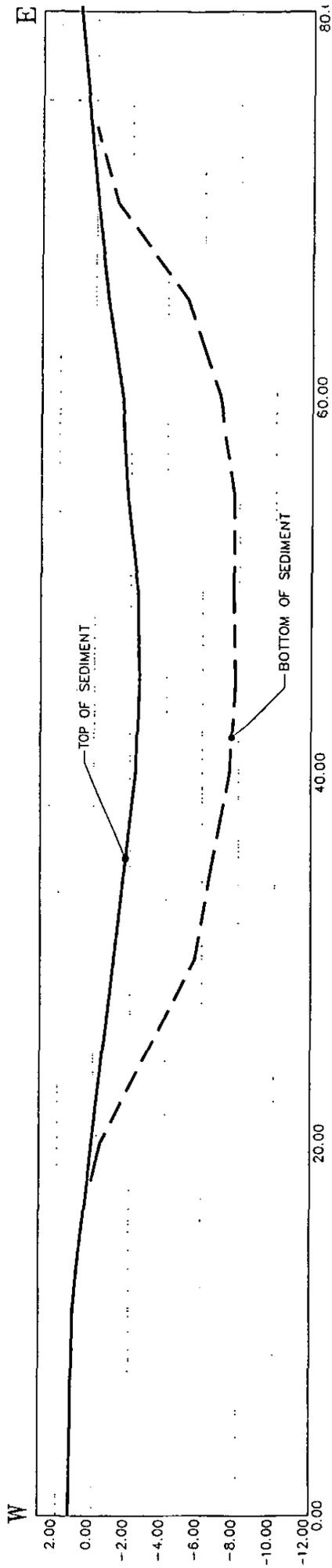
SECTION 98+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



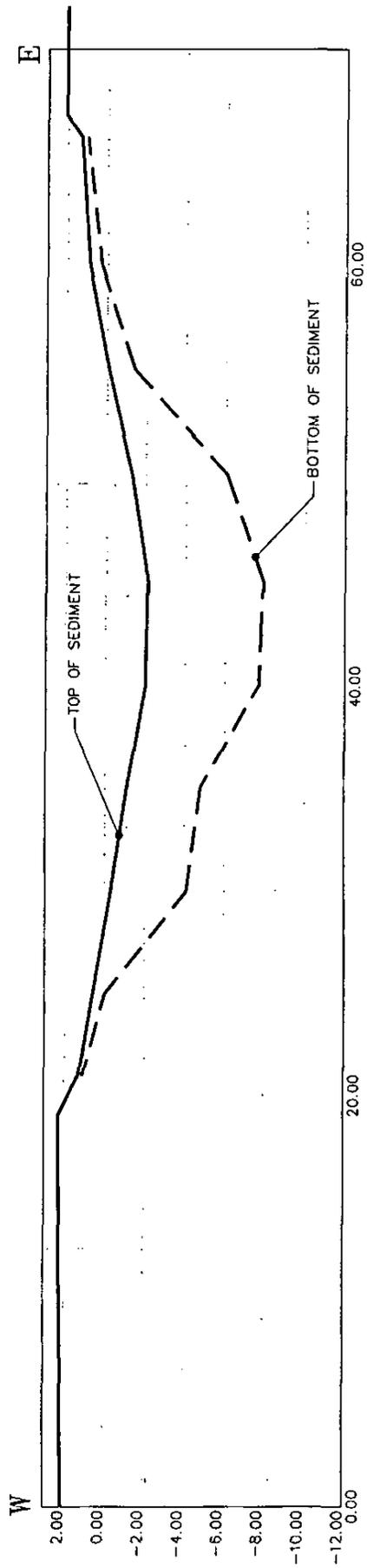
SECTION 99+00

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



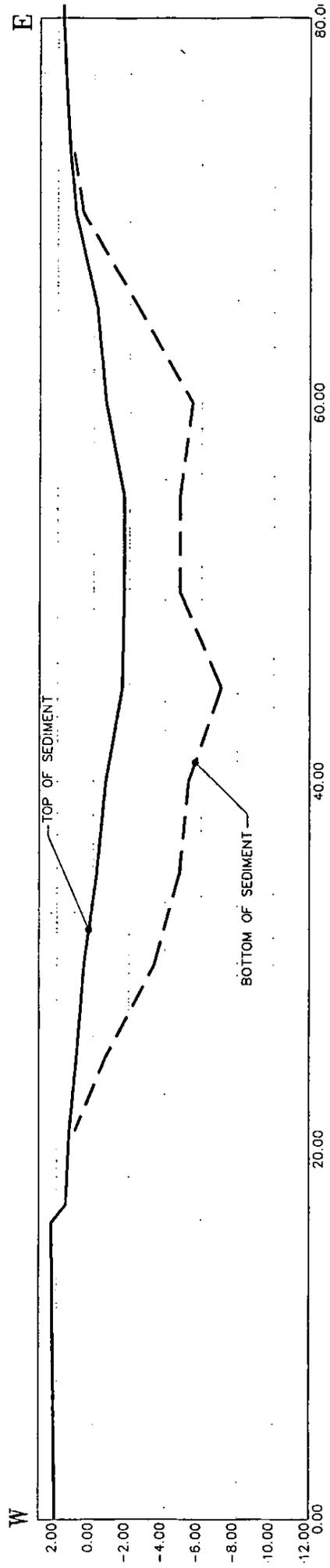
**SECTION 100+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



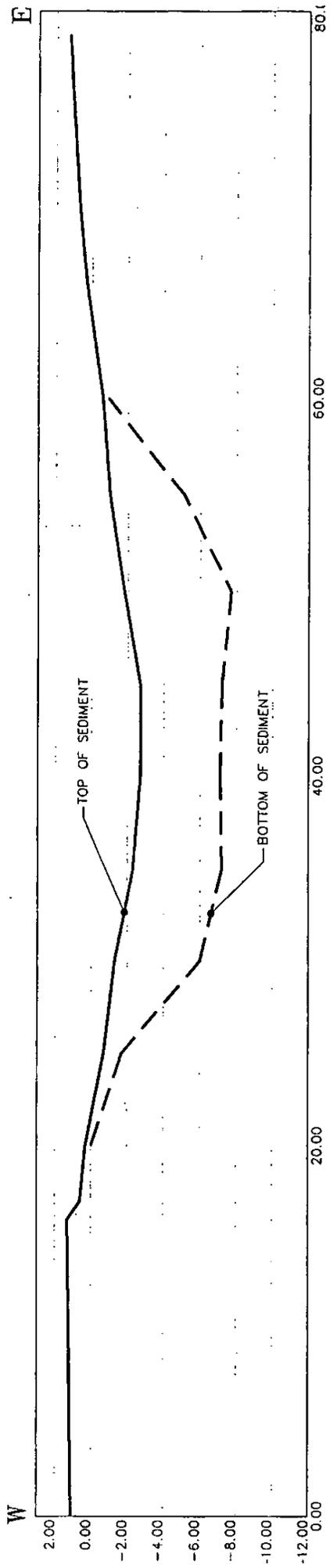
**SECTION 101+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



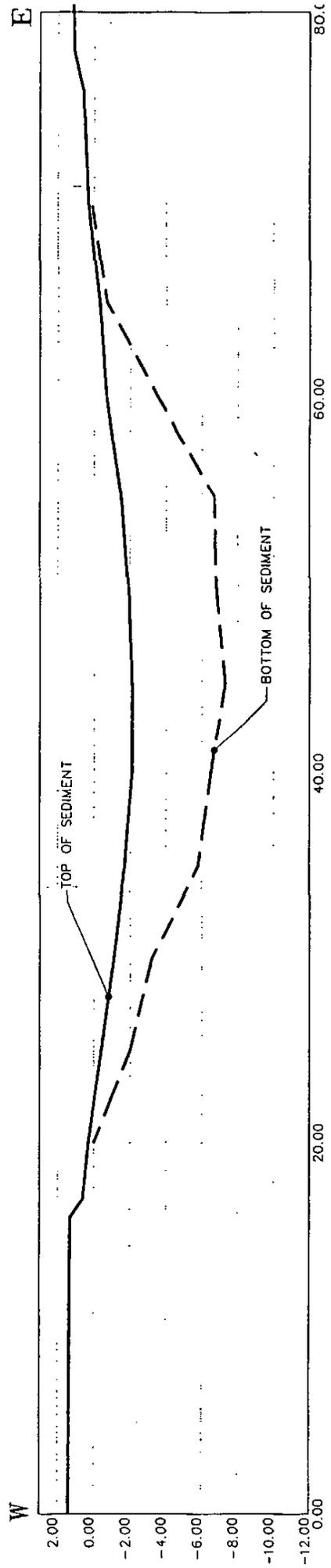
SECTION 102+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



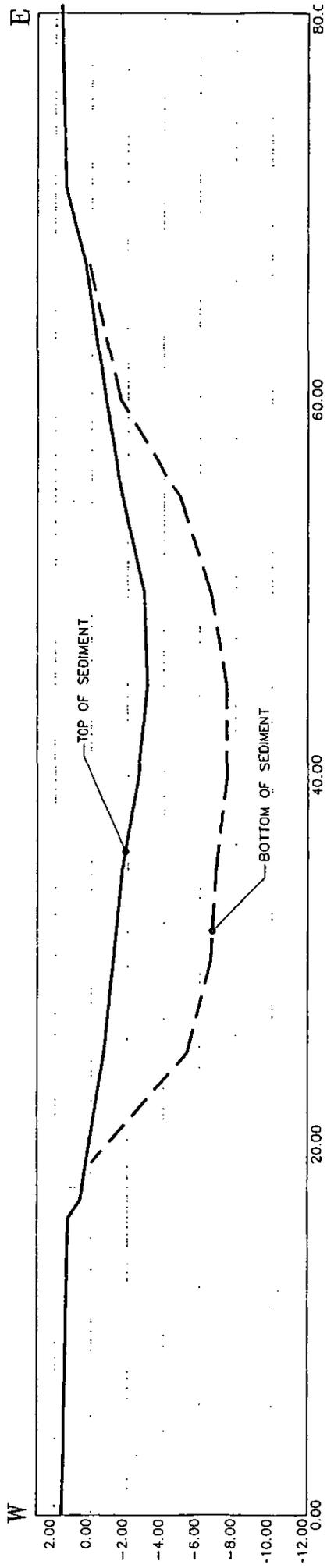
SECTION 103+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



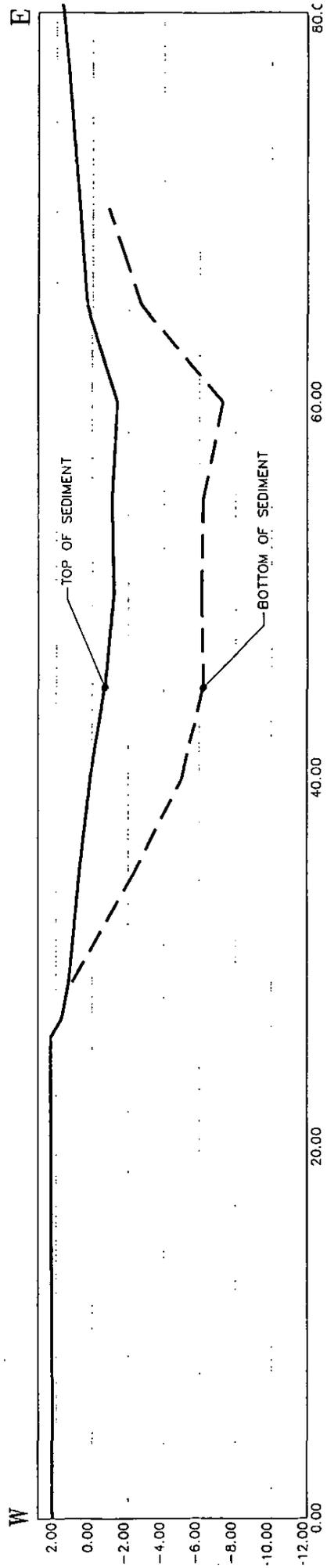
SECTION 104+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



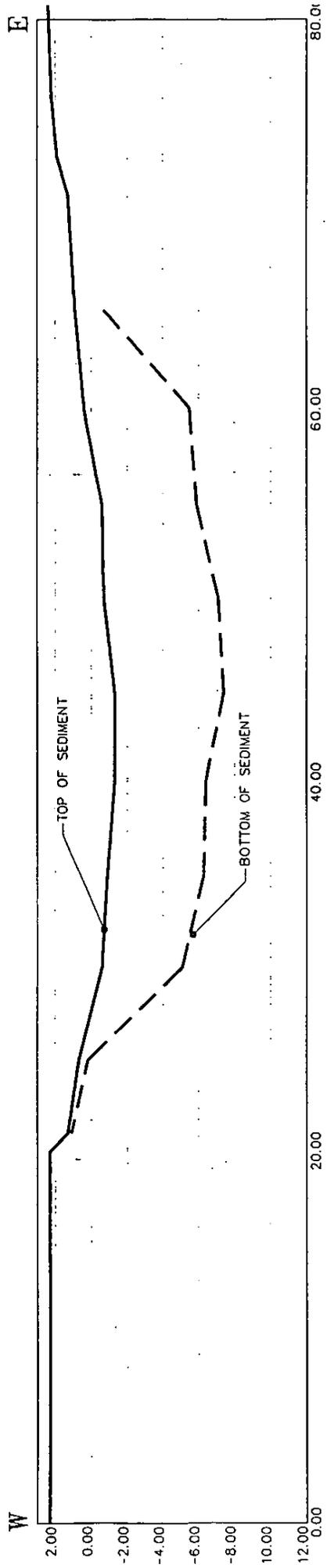
**SECTION 105+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



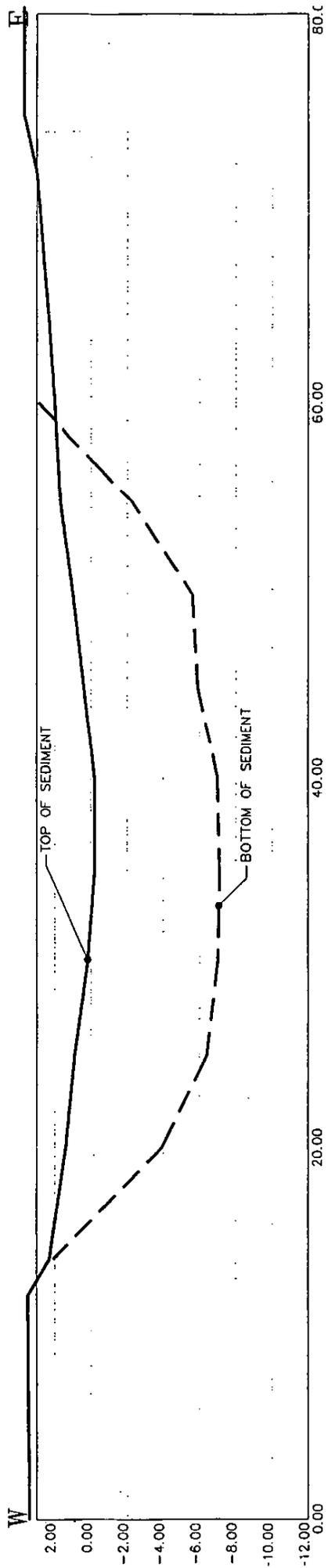
SECTION 106+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



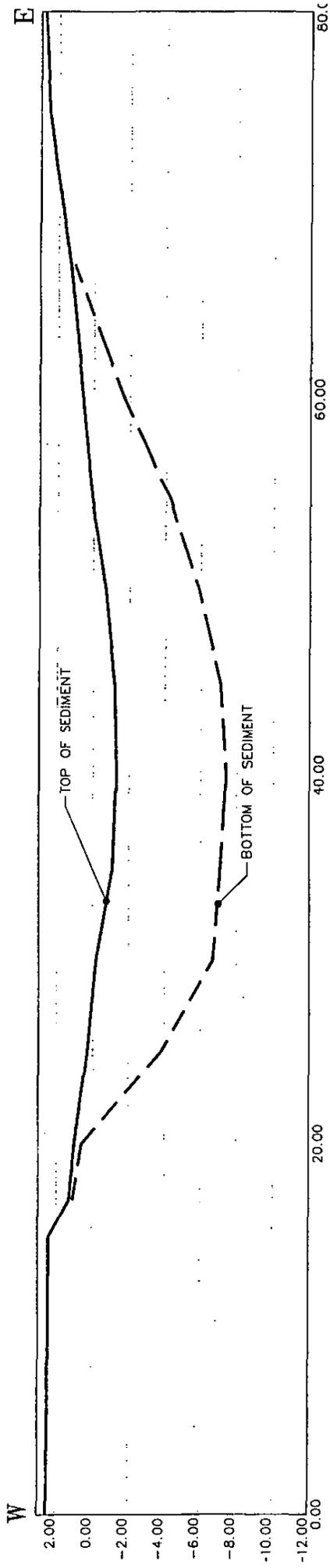
SECTION 107+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



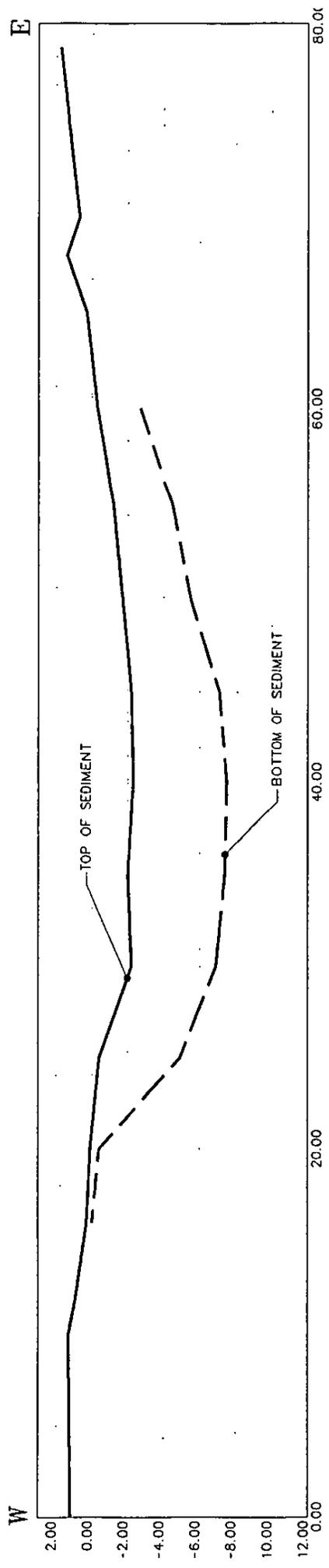
**SECTION 108+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



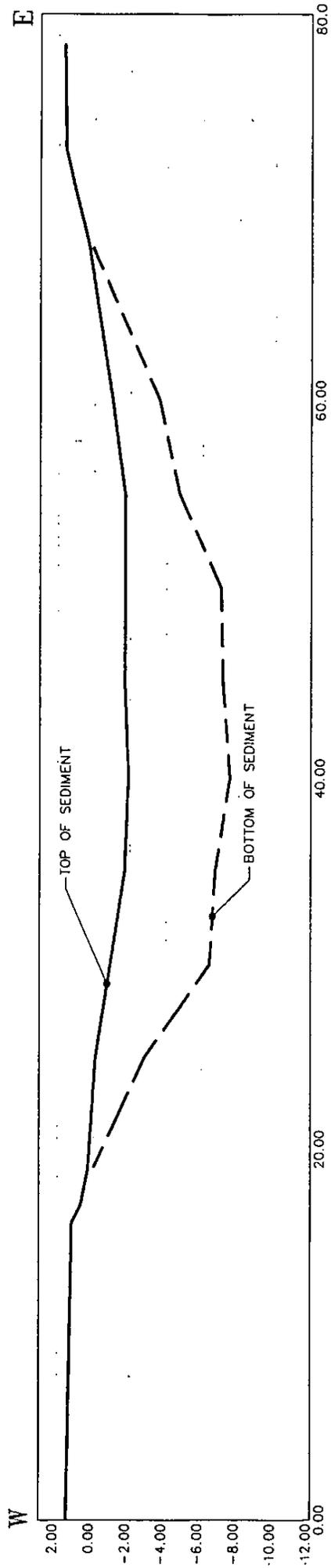
**SECTION 109+00**

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



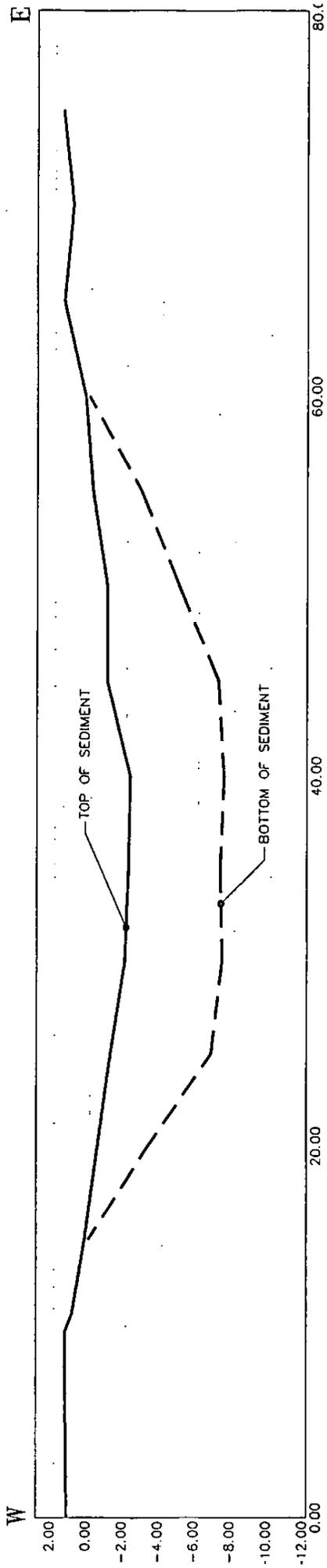
SECTION 110+00

SCALE: HORZ. 1"=5'  
 VERT. 1"=5'



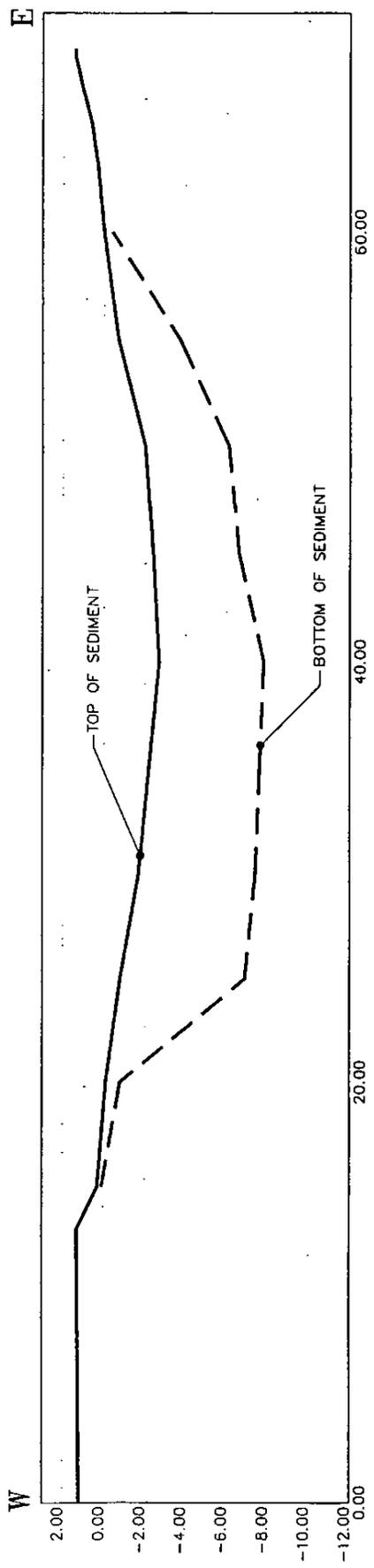
SECTION 111+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



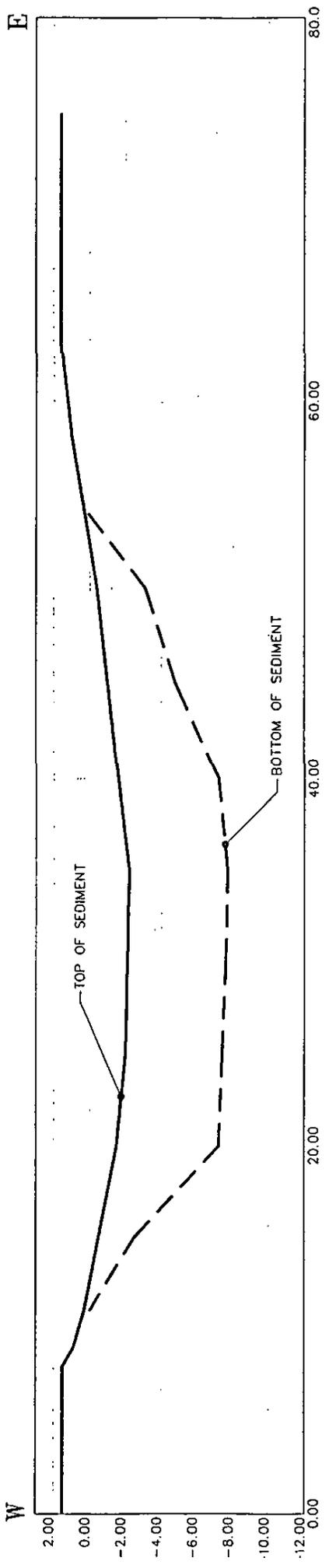
SECTION 112+00

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



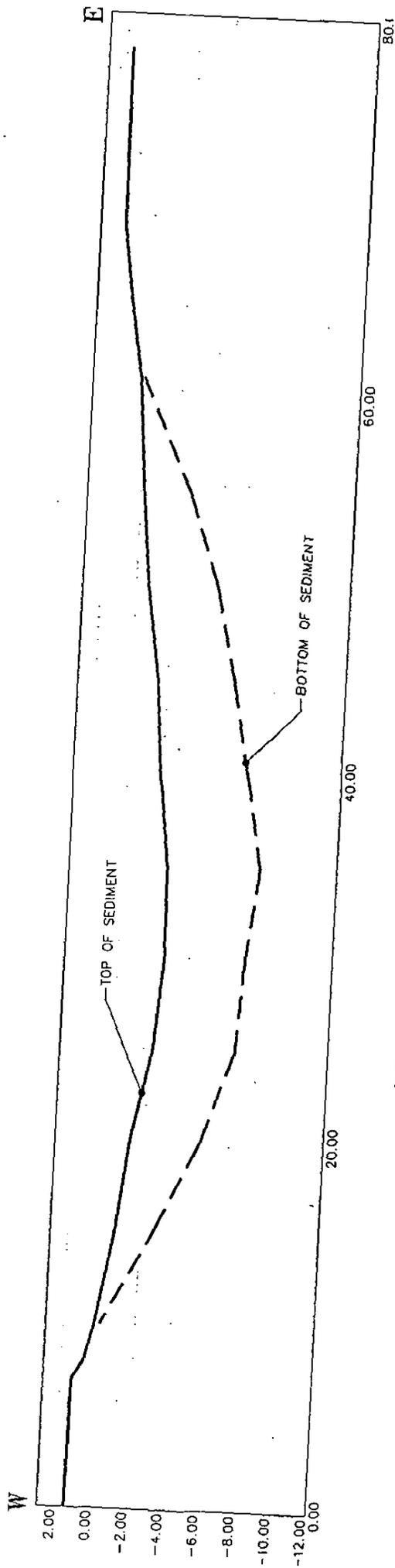
**SECTION 113+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



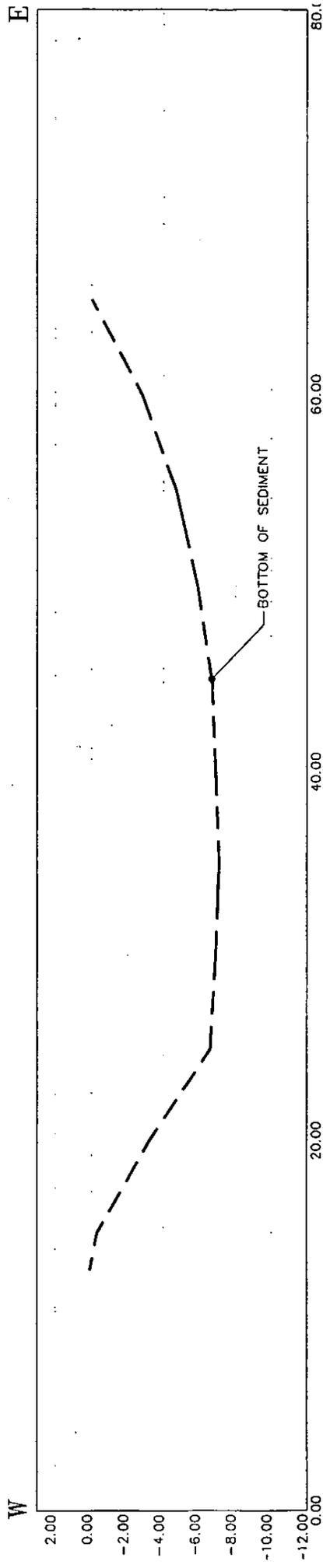
SECTION 114+00

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



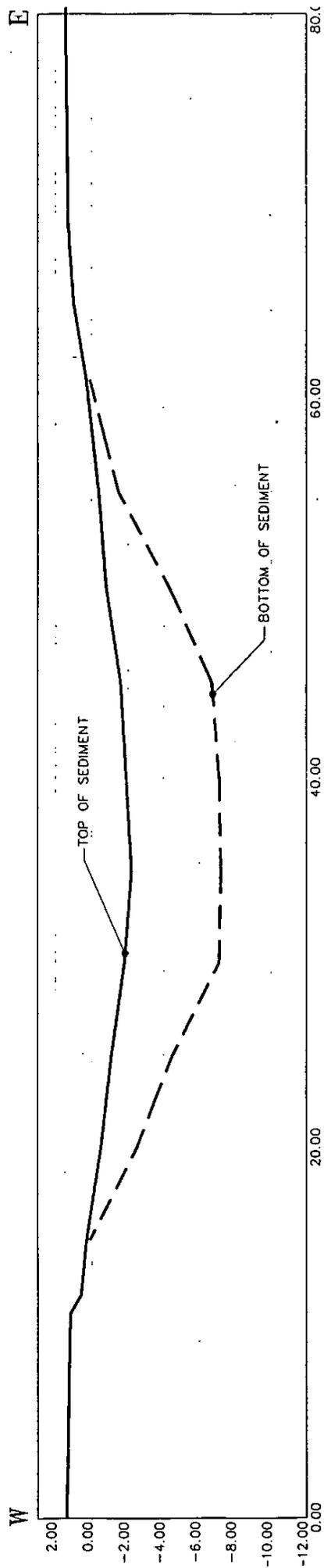
**SECTION 115+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



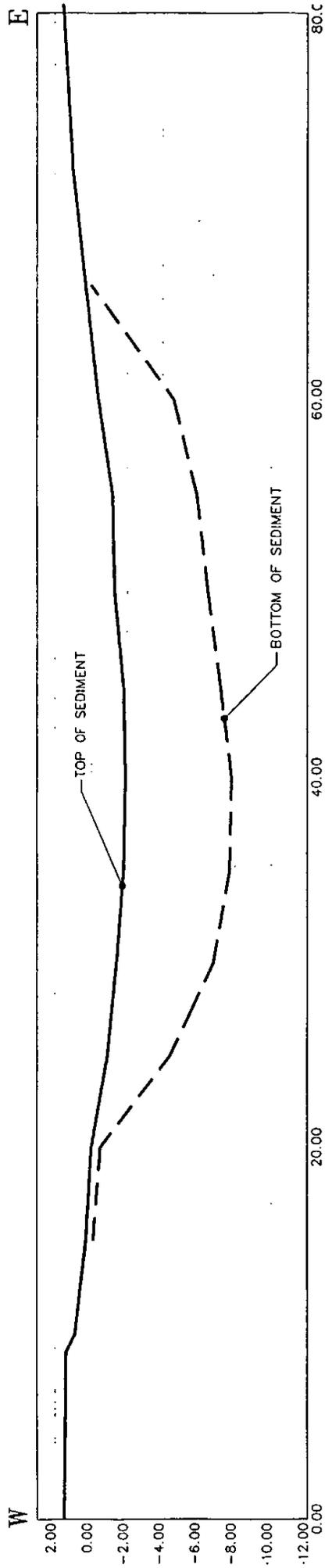
**SECTION 116+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



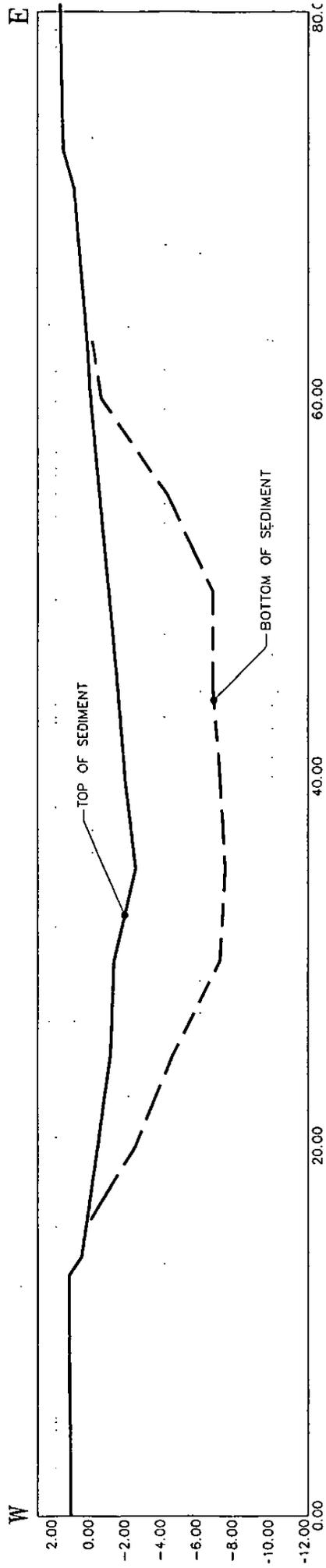
**SECTION 117+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



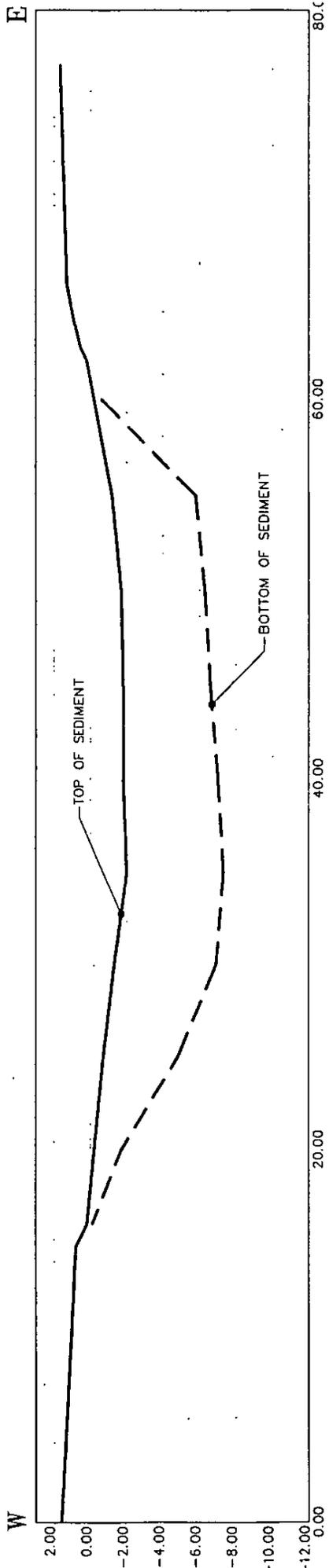
SECTION 118+00

SCALE: HORIZ. 1"=5'  
VERT. 1"=5'



SECTION 119+00

SCALE: HORZ. 1"=5'  
VERT. 1"=5'



**SECTION 120+00**

SCALE: HORZ. 1"=5'  
VERT. 1"=5'